

STUDENT NAME: A41749376  
Version B

GROUP T1

82

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
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6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B ☒ a. The reservoir will eventually disappear.  
☐ b. The reservoir is not in equilibrium.  
☐ c. The reservoir is growing smaller.  
☐ d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- D ☐ a. The Earth's atmosphere would become colder than it is today.  
☐ b. The Earth's atmosphere would become warmer than it is today.  
☐ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
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10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
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**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25 When water is mixed with  $\text{CO}_2$ , the result is Bicarbonate and Hydrogen ions. So if there was an increase in  $\text{CO}_2$  in the atmosphere, this would result in an increase in the pH level of the ocean, thus increasing ocean acidification. The increase in  $\text{CO}_2$  in the atmosphere would cause an increase in global temperature. Oceans are able to absorb more  $\text{CO}_2$  when the waters are colder. So though an increase in atmospheric  $\text{CO}_2$  would cause more carbon to be transferred from the atmosphere into the hydrosphere, the increased temperature of the oceans would slightly decrease the pH level in the oceans. This is an example of a positive feedback loop b/c an increase in  $\text{CO}_2$  in the atmosphere would increase ocean acidification, but also a negative feedback as an increase in  $\text{CO}_2$  in the atmosphere will increase the temperature of the oceans, resulting in less  $\text{CO}_2$  being absorbed by the oceans.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

22

The sun heats the Earth with visible heat rays that are not absorbed by greenhouse gases, due to their short wavelength. Once they reach the Earth surface, these heat rays are either absorbed or reflected by the surface. The reflected rays do not heat up the atmosphere. The absorbed visible rays are re-emitted as infrared rays in the atmosphere until they are absorbed by the greenhouse gas (methane,  $\text{CO}_2$ ,  $\text{H}_2\text{O}$ ). Once the greenhouse gases absorb these infrared rays, they become excited and re-emit them in all directions. The rays that are re-emitted towards Earth's surface go through the same process of being absorbed, and possibly re-emitted into the atmosphere. Again these infrared heat rays are absorbed by the greenhouse gases, essentially "trapping" them into Earth's atmosphere.

An increase in volcanism would increase the amount of  $\text{CO}_2$  in the atmosphere, due to the large ash clouds. This would increase the amount of greenhouse gases in the atmosphere that trap infrared heat in. This would result in an increase in the Earth's atmospheric temperature, even though the ash clouds block out incoming solar radiation.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both evaporation and degassing can transfer Carbon in the gas state.



Earn up to 1 additional point on your course grade

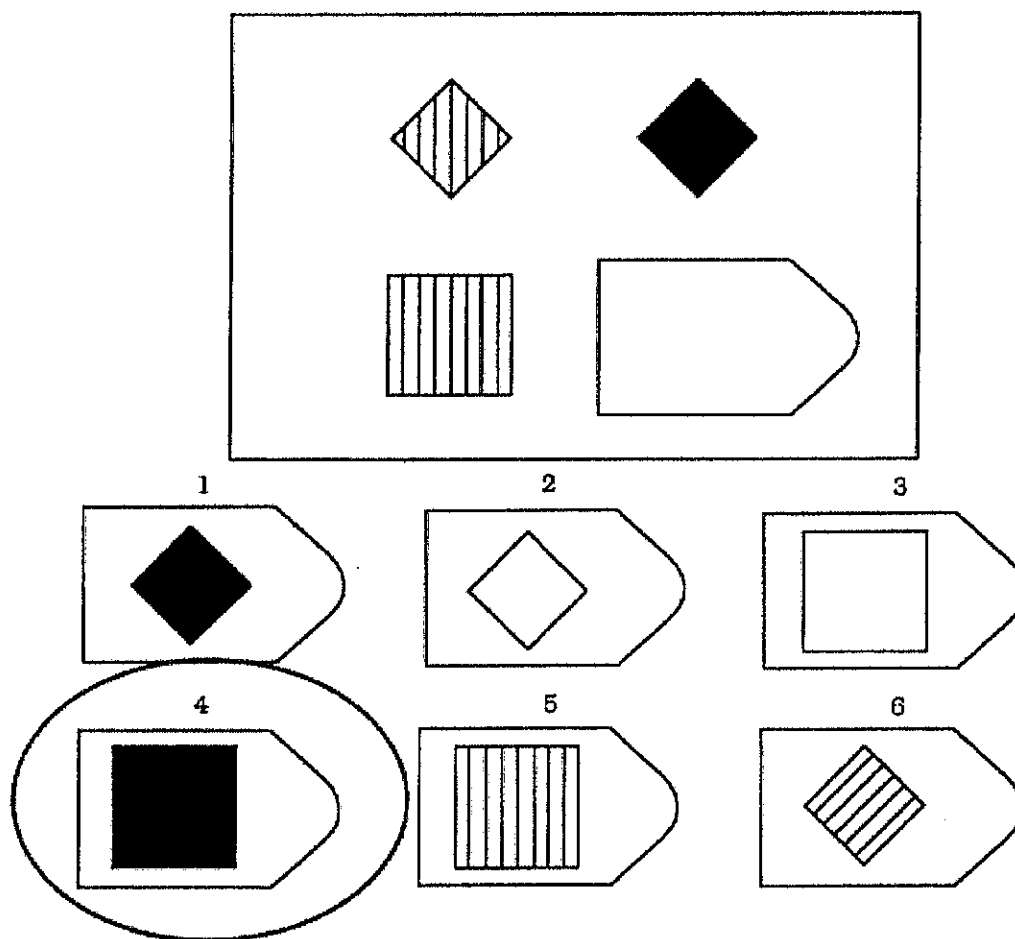
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# Analogical Assessment

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*Example*

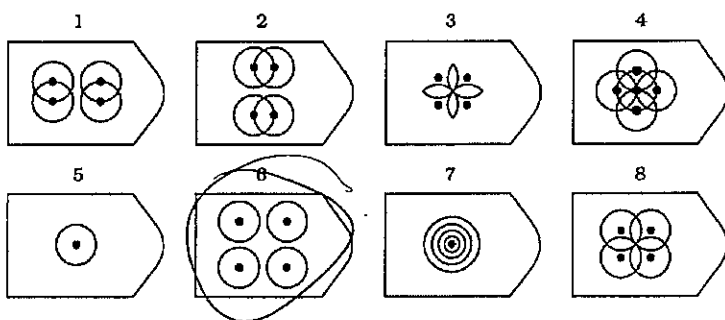
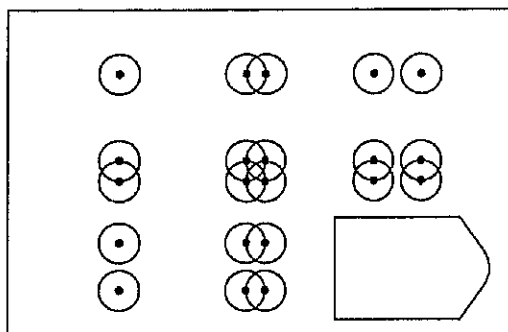


**Answer: 4**

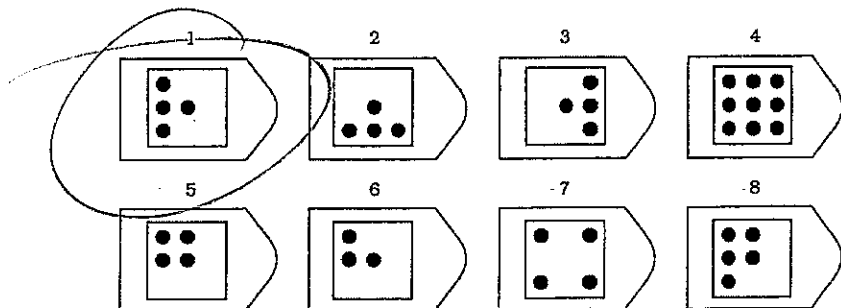
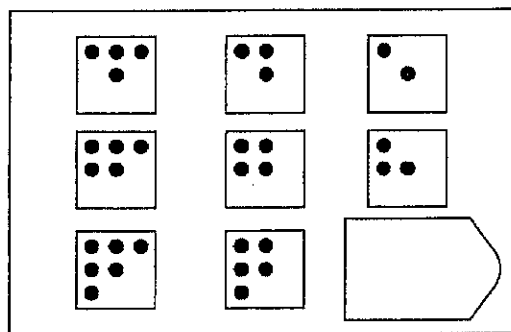
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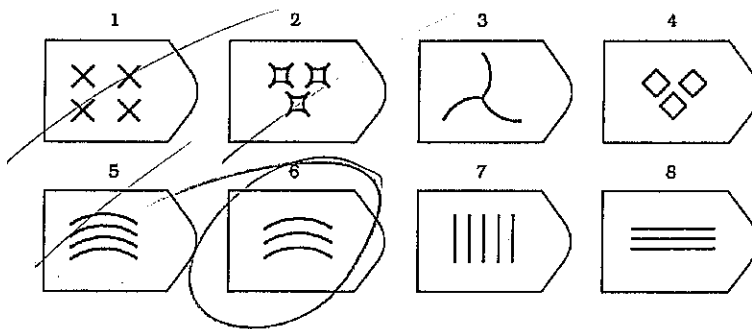
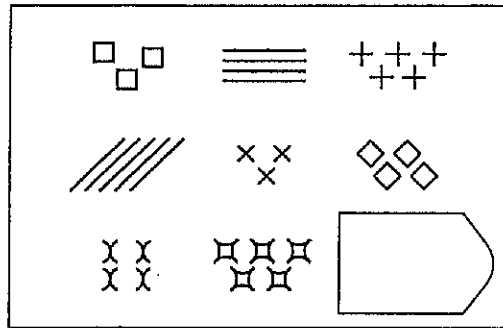
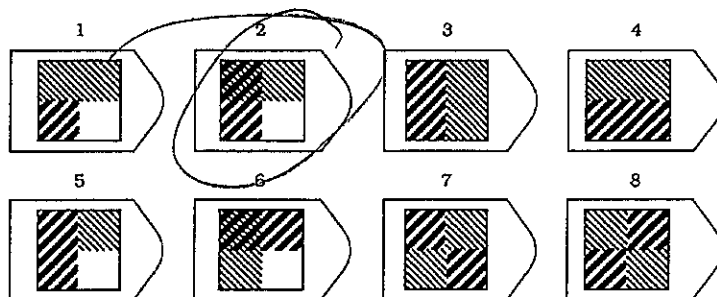
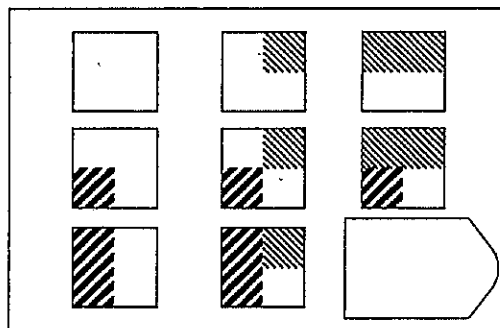
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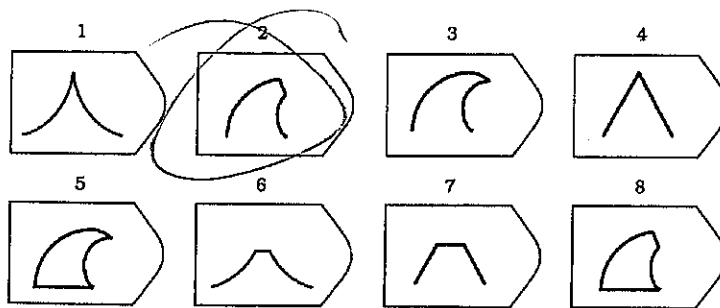
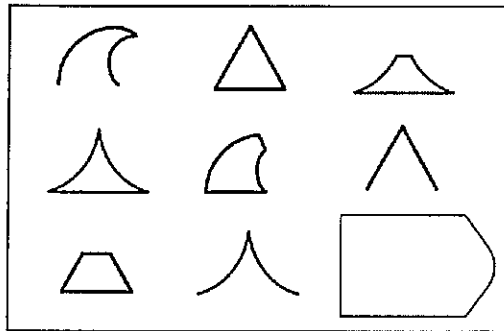


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PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

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In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

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5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- ☐ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- ☐ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- ☐ D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☐ A. Getting high. They are both involve too much of a chemical influencing the body.
- ☐ B. Hitting your head. They both involve something that causes headaches.
- ☐ C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- ☐ E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- ☐ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☐ C. Clouds forming. They are similar because they both involve a phase change.
- ☐ D. Building a house. They are similar because they both involve building a structure.

### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48070

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 41694022

GROUP: T1

80

Version B

**MULTIPLE-CHOICE. 5 points each (50 points total).**

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**SHORT ANSWER. 25 points each (50 points total)**

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Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

To start, an increase in atmospheric  $\text{CO}_2$  will increase ocean acidification. An increase in  $\text{CO}_2$  in the atmosphere will also cause temperature in the hydrosphere and atmosphere to increase. The increased  $\text{CO}_2$  in the atmosphere will increase  $\text{CO}_2$  in the hydrosphere by dissolution. Ocean acidification is the increase in  $\text{CO}_2$  in the oceans, which creates a higher pH level, making it more acidic. An example of a positive feedback loop for ocean acidification would be the increase atmospheric temperature because of increased  $\text{CO}_2$  will cause an increase in the  $\text{CO}_2$  in the ocean through dissolution. Increase in  $\text{CO}_2$  in ocean will allow for more degassing which brings more  $\text{CO}_2$  to the atmosphere, and eventually back to oceans. Negative Feedback would be the increase in  $\text{CO}_2$  in the atmosphere increases the temperature of oceans. The increased temperature of oceans will hold less  $\text{CO}_2$  because warm water cannot hold as much  $\text{CO}_2$  as cold water thus decreasing overall acidity of the ocean.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanic ash in the atmosphere will decrease atmospheric temperature. These clouds of ash will reflect <sup>from</sup> sunlight back out of the atmosphere before it is able to heat the atmosphere by being absorbed and re-emitted by earth's surface and turned into Infrared which is then absorbed and re-emitted by greenhouse gases and turned finally to heat the atmosphere (greenhouse effect).  
So in conclusion, the ash clouds reflect the sunlight before it can be turned to heat by the greenhouse effect.

Q3 22

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are similar because they both move something higher into the atmosphere. They are different because degassing can make something more dense and evaporation turns liquid into vapor, making

Earn up to 1 additional point on your course grade

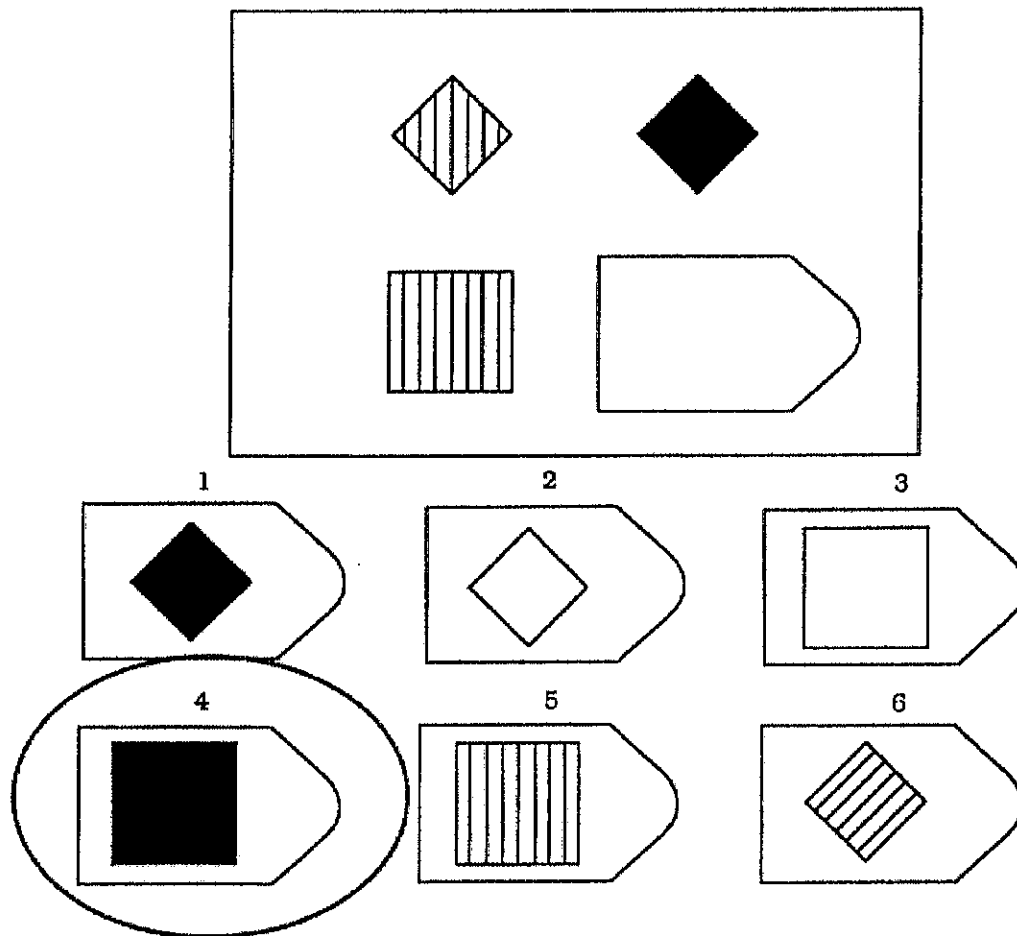
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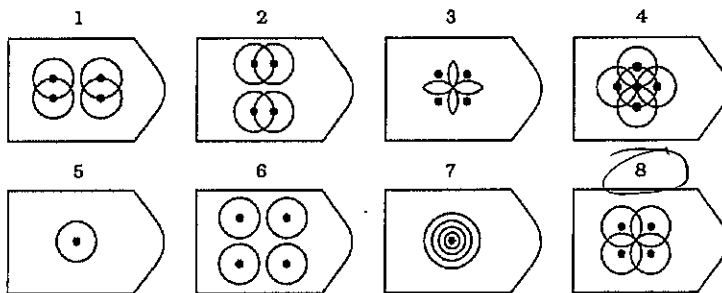
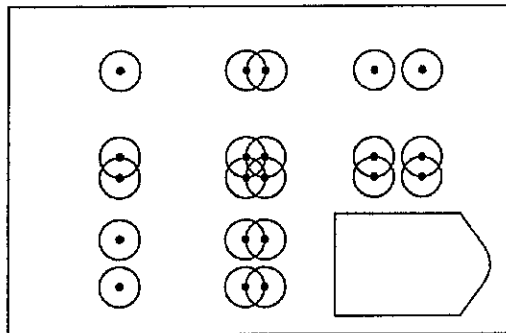


**Answer: 4**

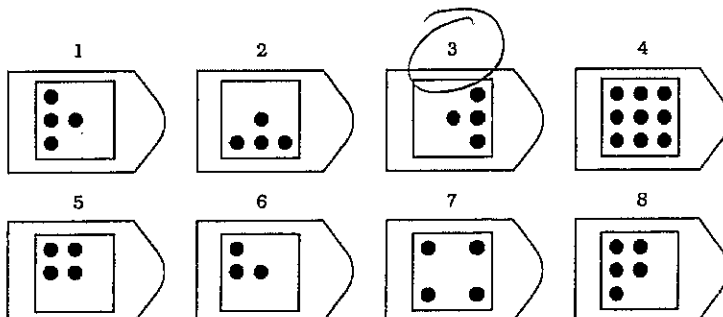
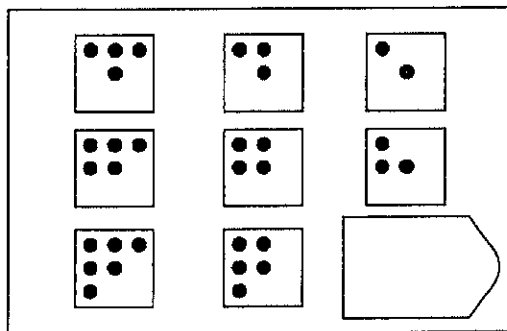
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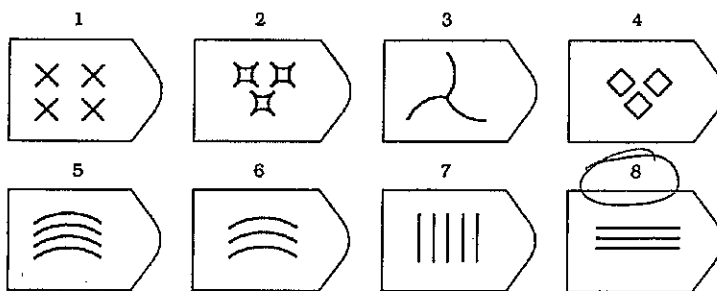
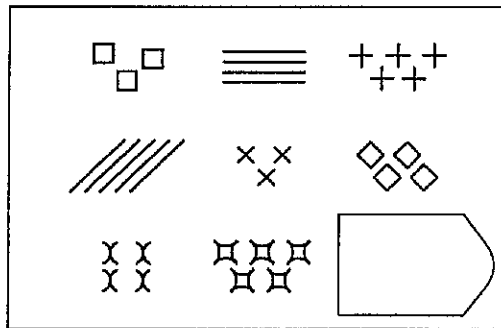
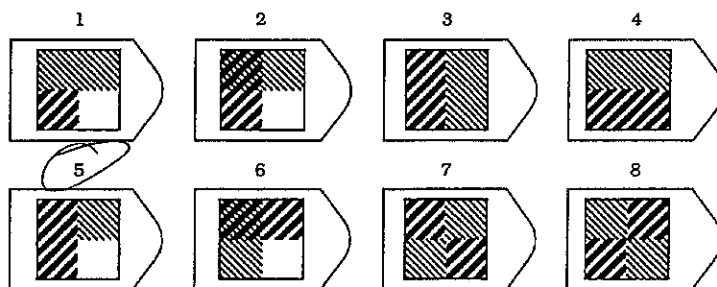
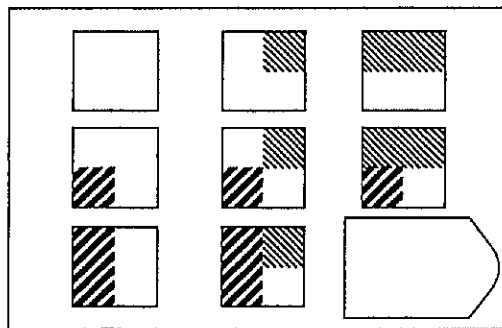
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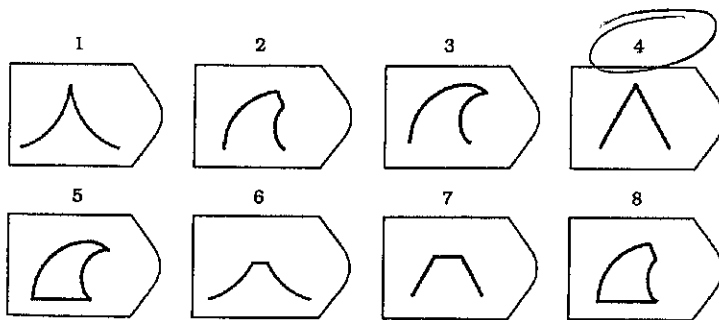
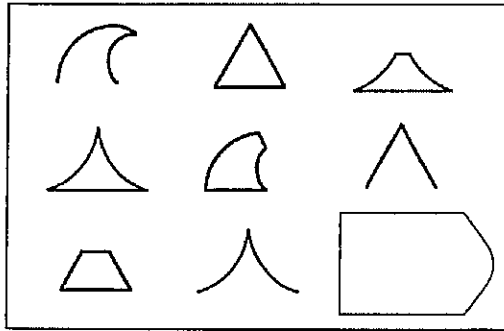
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

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- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- ☒ D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48070

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

**STUDENT NAME:** A43573450

**GROUP:** T1

Version B

1  
21

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- ☒ 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- ☐ 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
- ☐ 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ☒ d. A = dissolution, B= deposition, C= uplift and deposition
- ☒ 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- ☐ 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- ☒ 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- D 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- B 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- A 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

## SHORT ANSWER. 25 points each (50 points total)

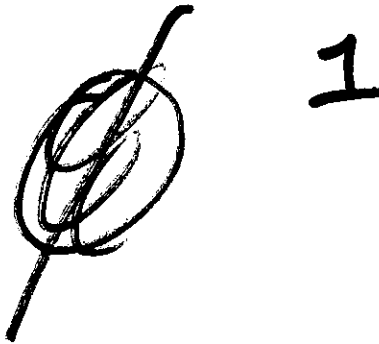
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would affect ocean acidification because with the increase of  $\text{CO}_2$  there would be less  $\text{O}_2$  in the air and the air would "borrow"  $\text{O}_2$  from the ocean therefore adjusting the molecular setup of the ocean and would increase the acidity in the ocean.

As for positive and negative feedback loops, both would play a role. If there is an increase in acidification in the ocean, then you would see more positive feedback loops but if it decreased, then you would see negative.



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism on Earth suddenly increases then it would play a lot of roles. It would influence the atmospheric temperature because the clouds from the ash would block the UV rays from the sun. It would decrease the temperature and the clouds would just kind of sit there. It's sort of like the greenhouse effect because there are just natural gases that sit in the atmosphere.

10

21

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

they are similar because with evaporation, liquid is getting pulled up to the sky/clouds and degassing pulls the gas out of the area.

Earn up to 1 additional point on your course grade

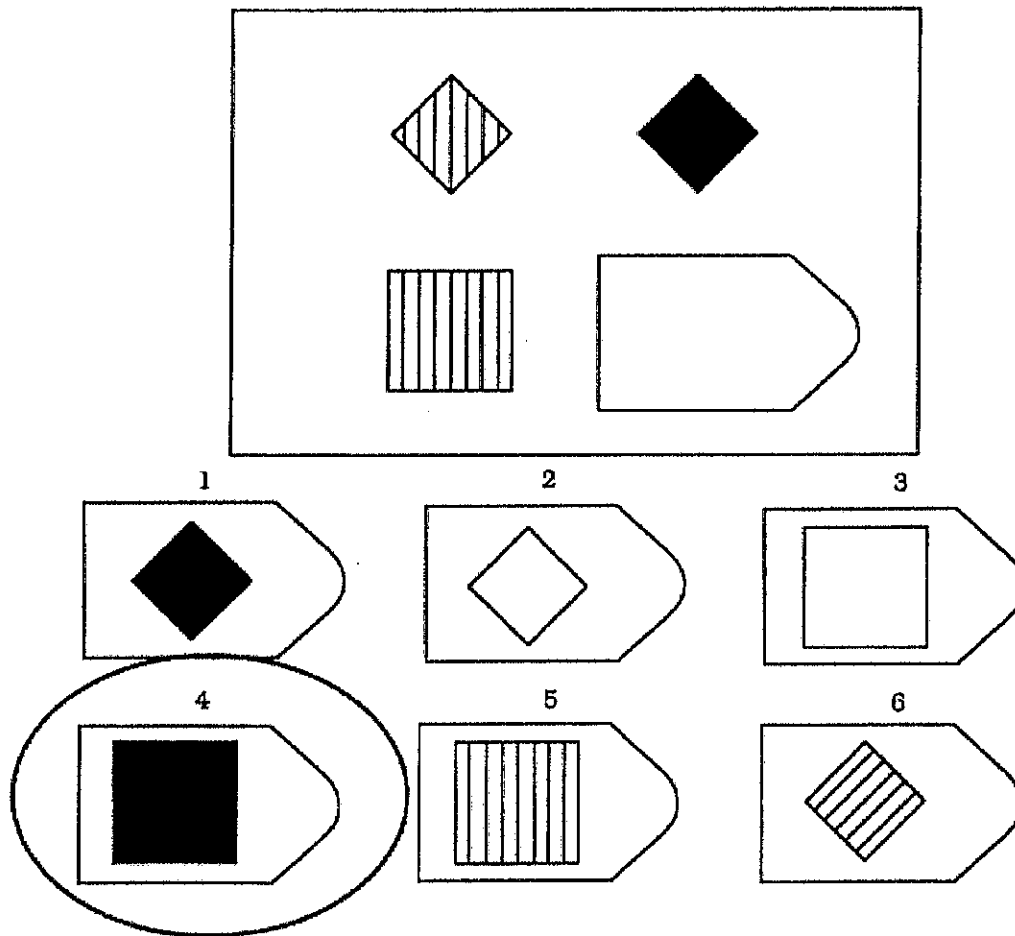
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



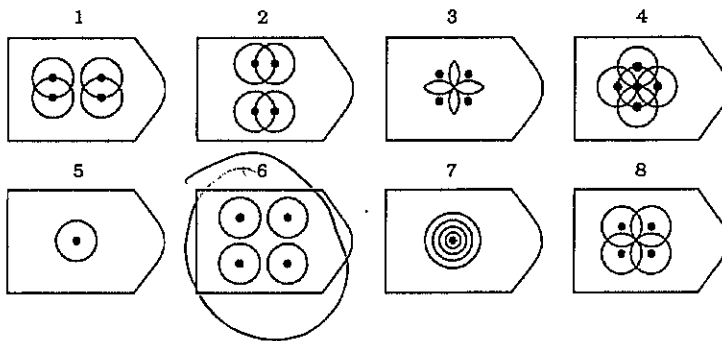
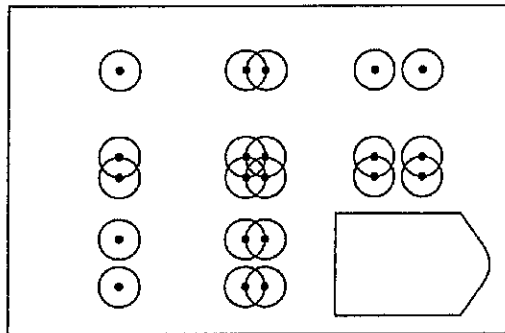
**Answer: 4**

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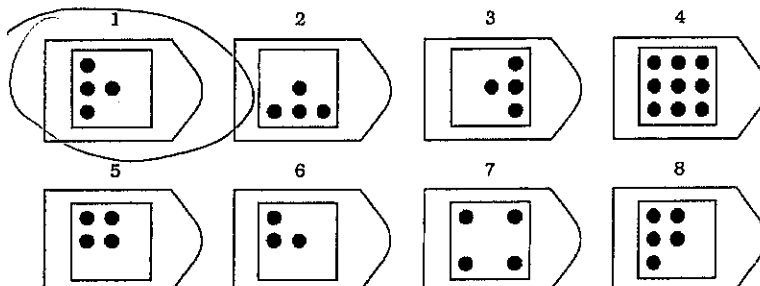
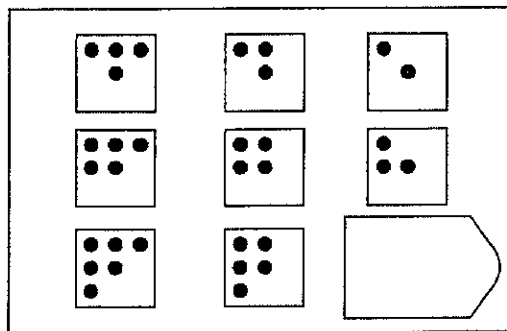


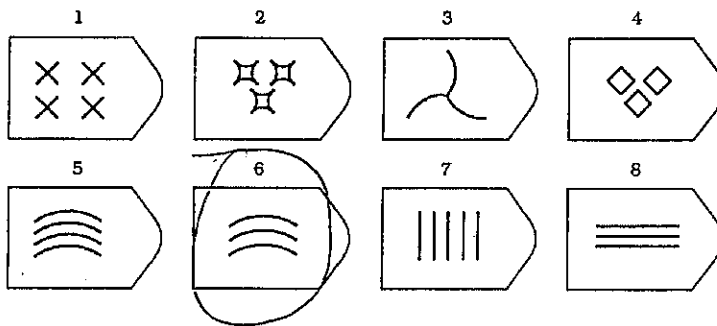
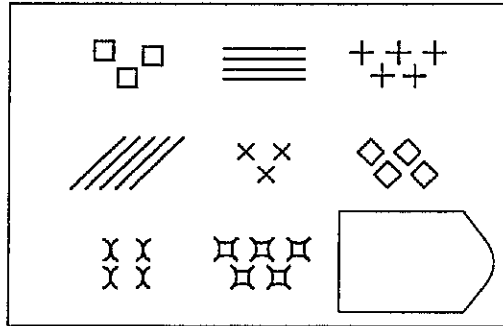
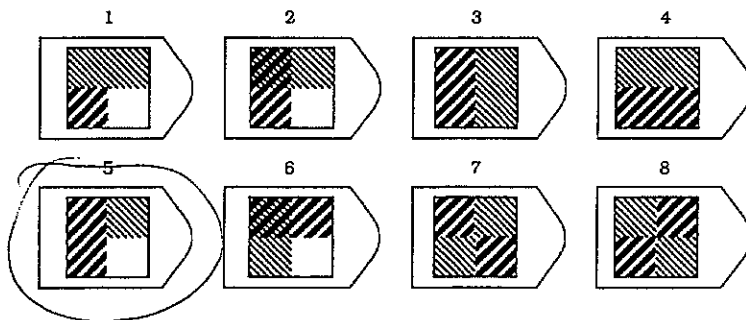
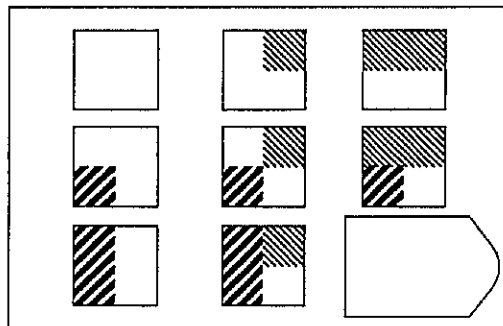
Please choose the image that best completes each of the following patterns.

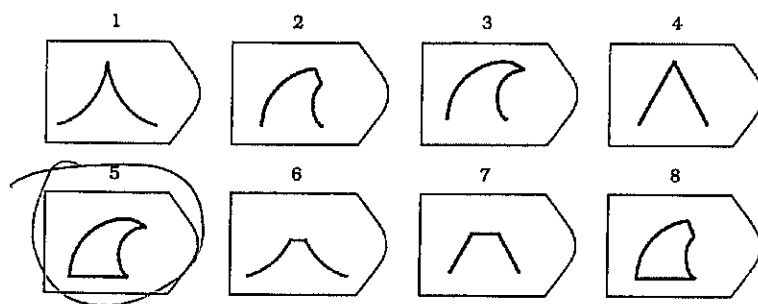
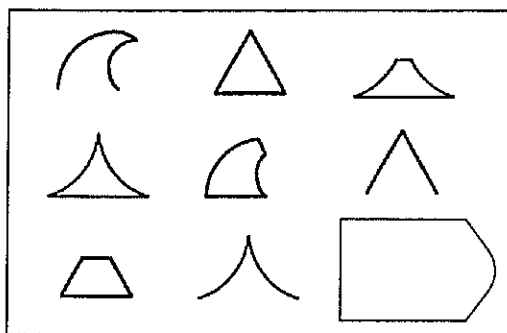
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
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- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

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- C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 60163

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A40700302

GROUP T1

Version A

45

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- a. The magma becoming colder  
b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter  
☒ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.

$$A: 200 \div 10 = 20$$

$$B: 100 \div 10 = 10$$

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

B

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

~~8.~~ Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?  $T \downarrow$

B

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

~~9.~~ Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?  $T \uparrow$

A

- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ~~b.~~ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- ~~d.~~ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

~~10.~~ What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

A

- ☒ a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

The increase in atmospheric carbon dioxide would increase ocean acidification. The pH level of the oceans would also increase. With more carbon dioxide in the atmosphere this means that more  $\text{CO}_2$  will be absorbed into the oceans. This process is a positive Feedback loop. It is a positive Feedback loop because the increase in  $\text{CO}_2$  in the atmosphere will just cause more of an increase in  $\text{CO}_2$  ocean acidification. The ocean becomes more acidified because of a couple factors. These factors could be caused from an increase in manufacturing which is most likely. With more  $\text{CO}_2$  in the atmosphere because of this, more  $\text{CO}_2$  will eventually end up in the oceans. The  $\text{CO}_2$  ends up in the oceans because of precipitation into ~~the~~ oceans, or just the absorption of the  $\text{CO}_2$  in the atmosphere into the oceans. Overall, an increase in atmospheric carbon dioxide will cause an increase in ocean acidification.

This is a negative Feedback loop because the increase in  $\text{CO}_2$  will cause a change in temperature of the ocean water. will cause an increase in temperature.



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

IF there was a sudden increase in volcanism on Earth, there would be a noticeable change in the Earth's atmospheric temperature. This would be a decrease in atmospheric temperature. There would be a decrease in atmospheric temperature for a few reasons. First, there would be less visible light from the sun in the atmosphere. With less visible light in the atmosphere, this means that there will be less infrared light bounced back off the Earth's surface into the atmosphere. Second, with less of this infrared light being reflected back into the atmosphere, there will be a decrease in greenhouse effect. What I mean by a decrease in greenhouse effect is there will be less of the atmosphere trapped <sup>EXPLAIN</sup> in what we call the greenhouse effect. This decrease in greenhouse effect gases is another reason why the temperature would decrease. Overall, if there was a sudden increase in volcanism on Earth with large ash clouds, it will cause a decrease in Earth's atmospheric temperature.

15

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are different because evaporation is when a liquid changes to a gas but degassing is when a solid changes to a gas. They are similar

Earn up to 1 additional point on your course grade

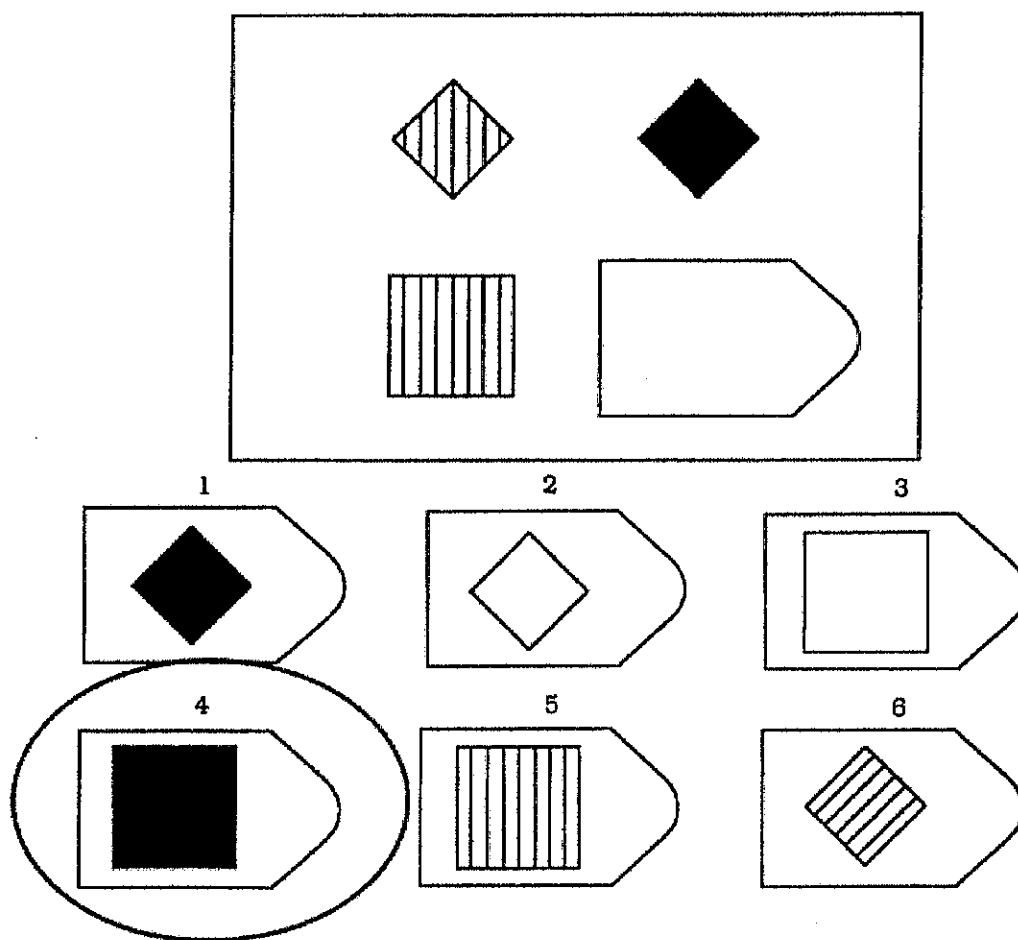
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

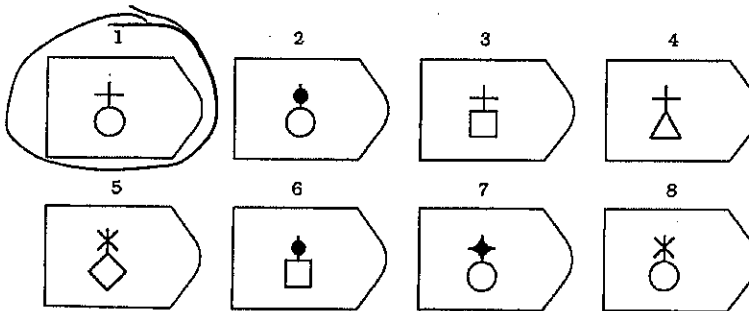
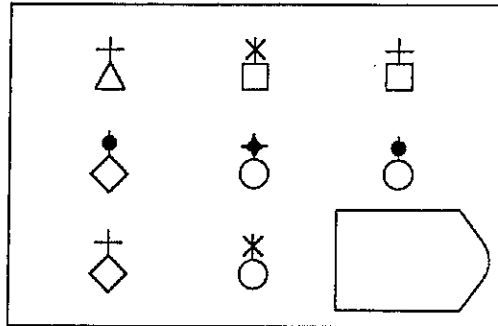


**Answer: 4**

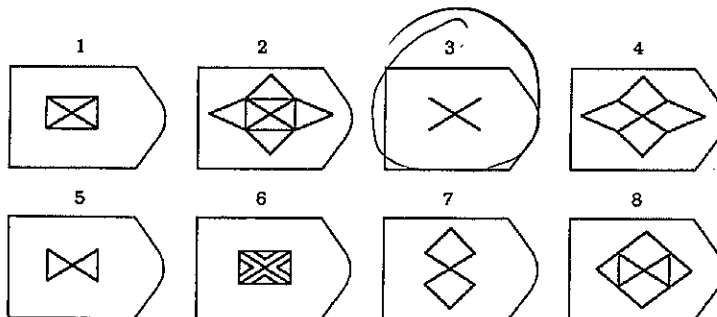
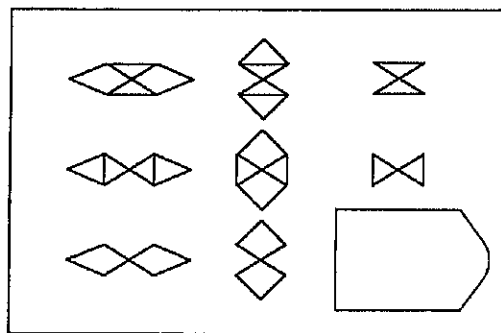
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Please choose the image that best completes each of the following patterns.

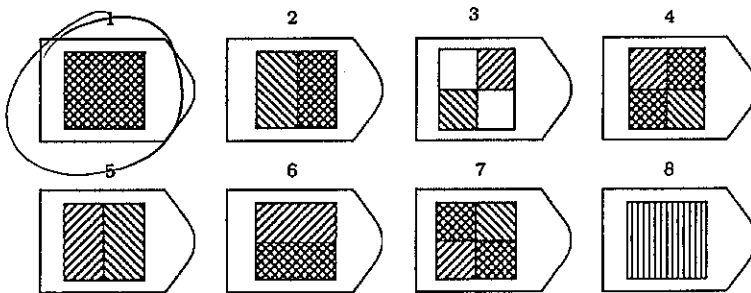
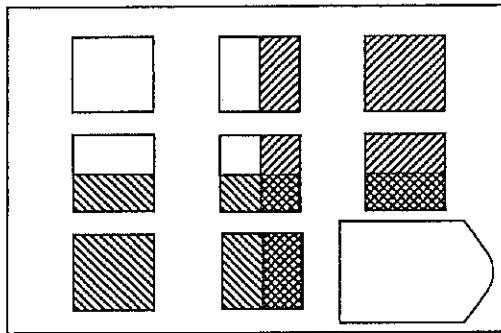
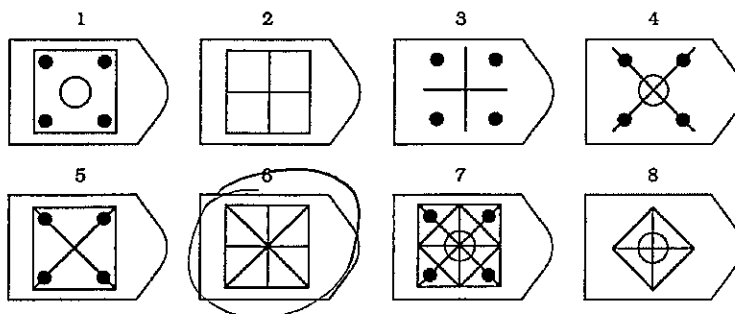
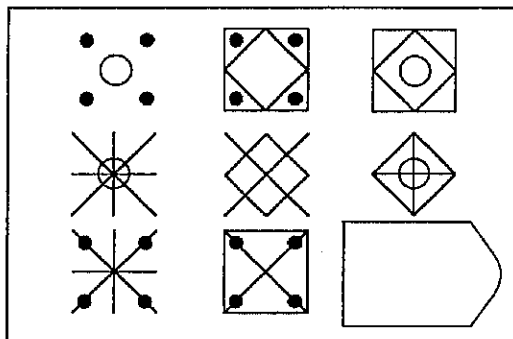
### PATTERN 1



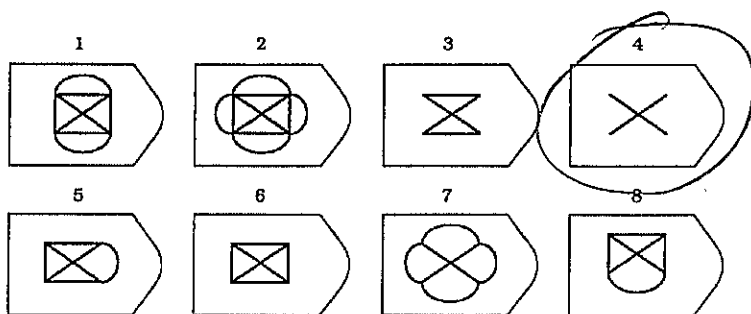
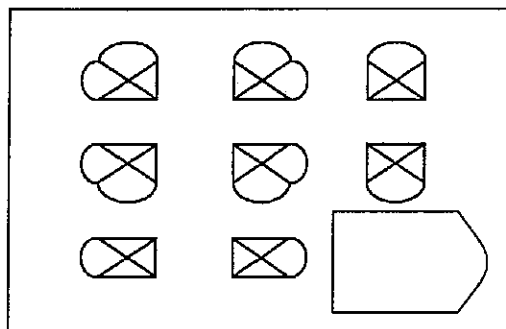
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

**Please choose the best analogy to each of the following statements.**

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

*PLEASE CONTINUE ON NEXT PAGE*

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48085

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



STUDENT NAME: A 46246306  
Version A

GROUP: T1

20

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - (d) Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - (c) An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - (b) A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - (b) Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - (c) A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- (a) Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

~~8.~~ Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- C
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☒ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

~~9.~~ Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- A
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

~~10.~~ What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

A4246306

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

When carbon dioxide is increased within the atmosphere, it usually is due to the cycle of water evaporating to condensation into clouds. When there are more clouds there is a higher amount of carbon dioxide being released into the atmosphere. When there is more  $\text{CO}_2$  in the atmosphere the residence time of the  $\text{CO}_2$  in the ocean will become extended. While positive & negative feedback loops tend to have a lasting & broader changing effect on atmospheric  $\text{CO}_2$ , including constant release of heat &  $\text{CO}_2$  which will heat the ocean causing more  $\text{CO}_2$  to move causing a positive feedback loop, & that therefore would lead to higher ocean acidification because only when atmospheric  $\text{CO}_2$  rises can ocean acidification do the same. A negative feedback loop could be a decrease in the earth's temperature which would increase the oceans pH level but ultimately cool it making it negative.

why?

V. unckar

10

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If the earth were to become engulfed dramatically with volcanism it would lead to a steady increase in temperature. If these volcanoes really erupt large ash clouds it would be due to gas bubbles & crystals within the magma that would cause it to rise faster. If there is an increase in magma that means there is a large force of heat causing it to rise, in effect the volcanoes would be releasing gaseous & hot heat into the atmosphere. If the number of volcanoes reached a high enough number it would eventually cause the atmospheric temperature to rise on Earth.



Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are similar in that they both convert chemical energy to thermal energy.

Earn up to 1 additional point on your course grade

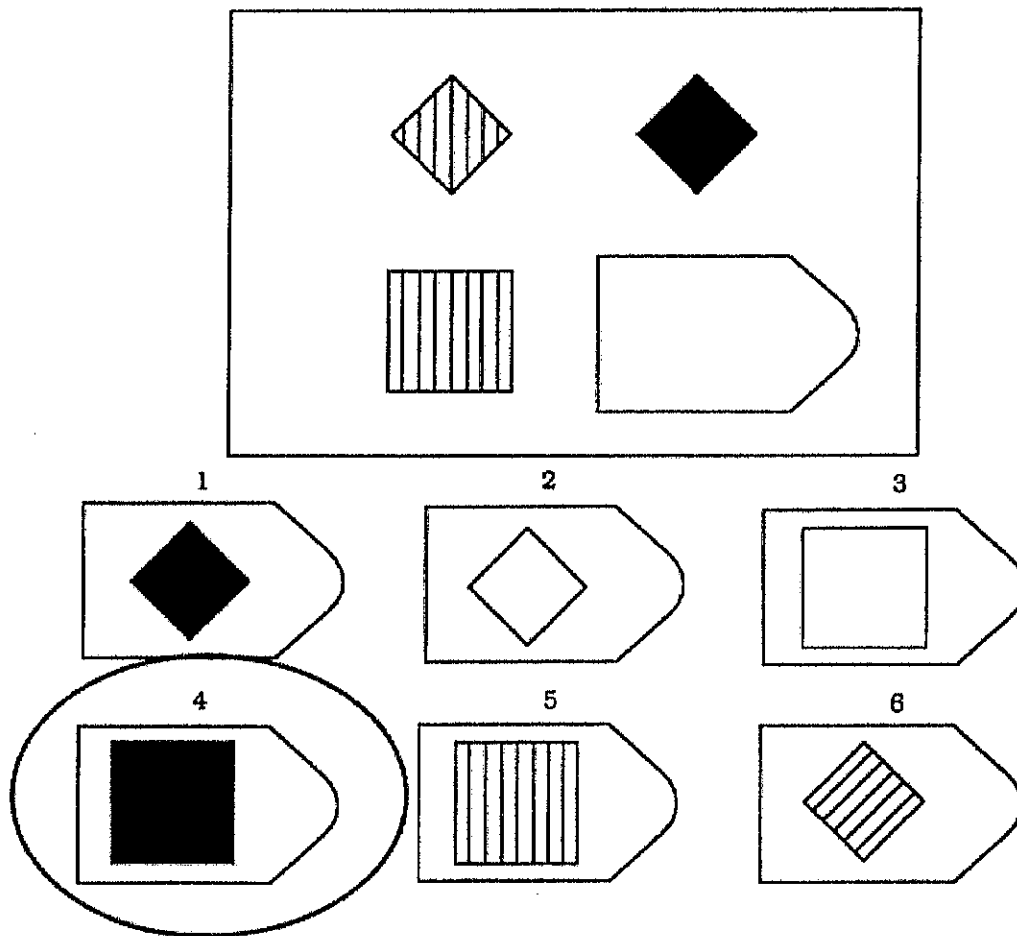
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

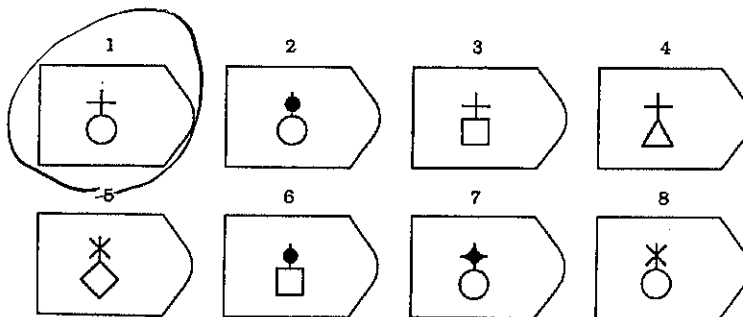
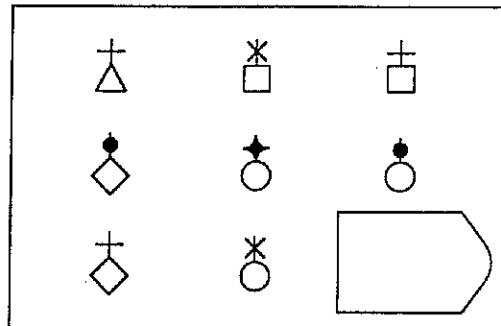


**Answer: 4**

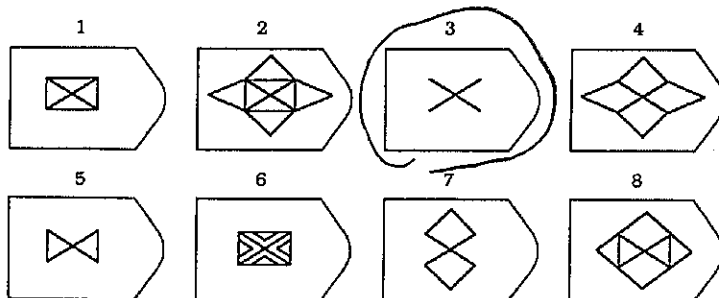
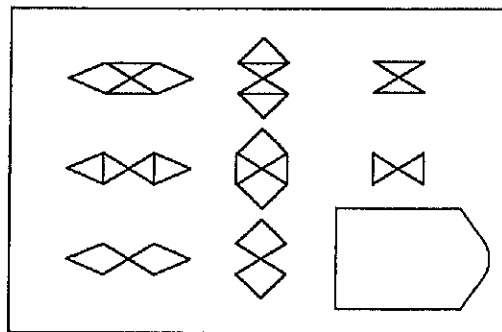
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Please choose the image that best completes each of the following patterns.

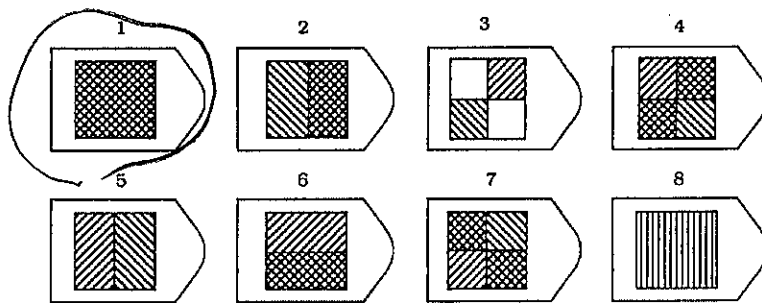
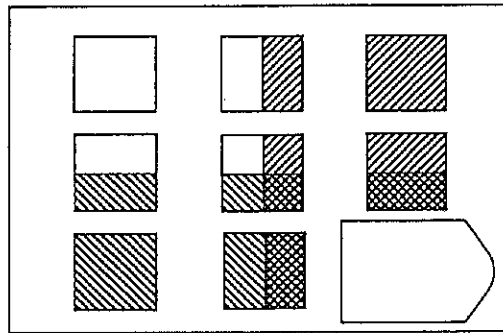
### PATTERN 1



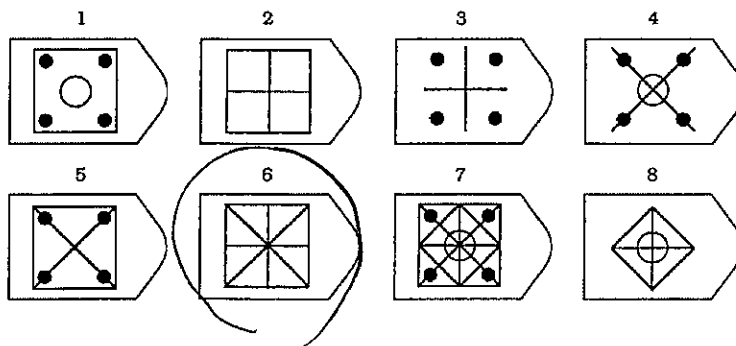
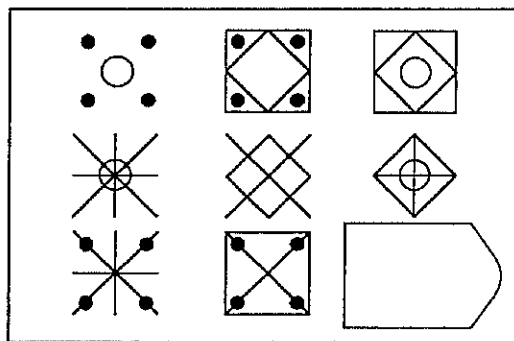
### PATTERN 2



**PATTERN 3**

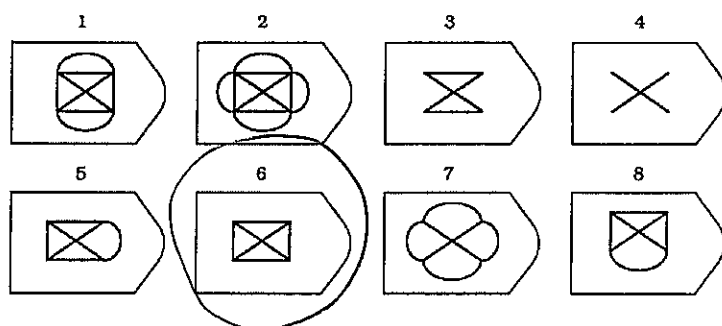
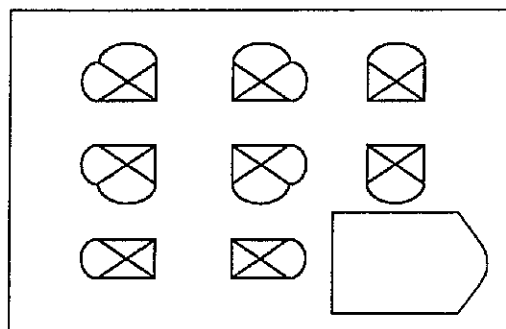


**PATTERN 4**



PLEASE CONTINUE ON NEXT PAGE



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- ☐ A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☐ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- ☐ D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- ☐ A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- ☐ B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- ☐ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
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3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

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4. The rival gangs used graffiti to define their territorial boundaries.

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PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
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Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
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  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - ☒ D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - ☒ C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 91076

What is your gender?

- ☒ Male
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What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A41427286  
Version A

GROUP: T2

1  
59

MULTIPLE-CHOICE. 5 points each (50 points total).

- B** 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b.** Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- C** 2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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  - D** c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- D** 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A = erosion, B = deposition, C = uplift and erosion
  - b. A = erosion, B = biochemical precipitation, C = uplift and deposition
  - c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d.** A = dissolution, B = deposition, C = uplift and deposition
- C** 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c.** Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- A** 5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a.** An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- B** 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b.** Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- Handwritten calculations:  
Res. A:  $2 \text{ } 0-1, I-1 \quad \frac{2}{1} = 2$   
Res. B:  $1 \text{ } 0-1, I-1 \quad \frac{1}{1} = 1$

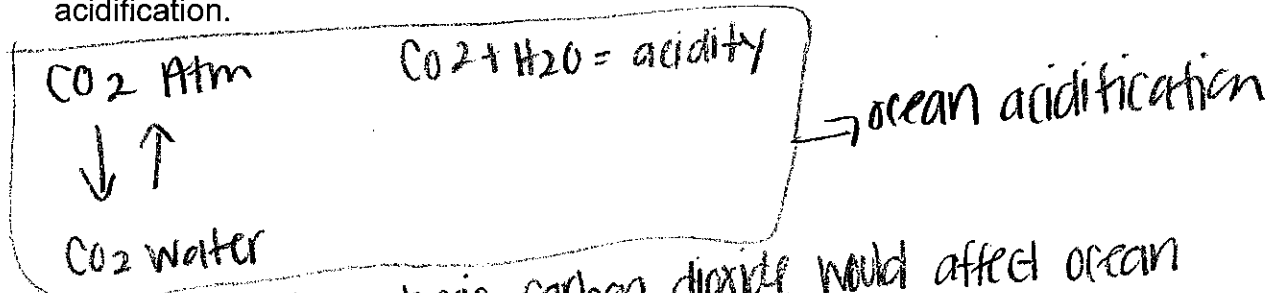
- B** 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- B**
- a. The reservoir will eventually disappear.
  - (b)** The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- B** 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A**
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - (b)** Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- C** 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- B**
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - (c)** Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- D** 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- B**
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - (d)** The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



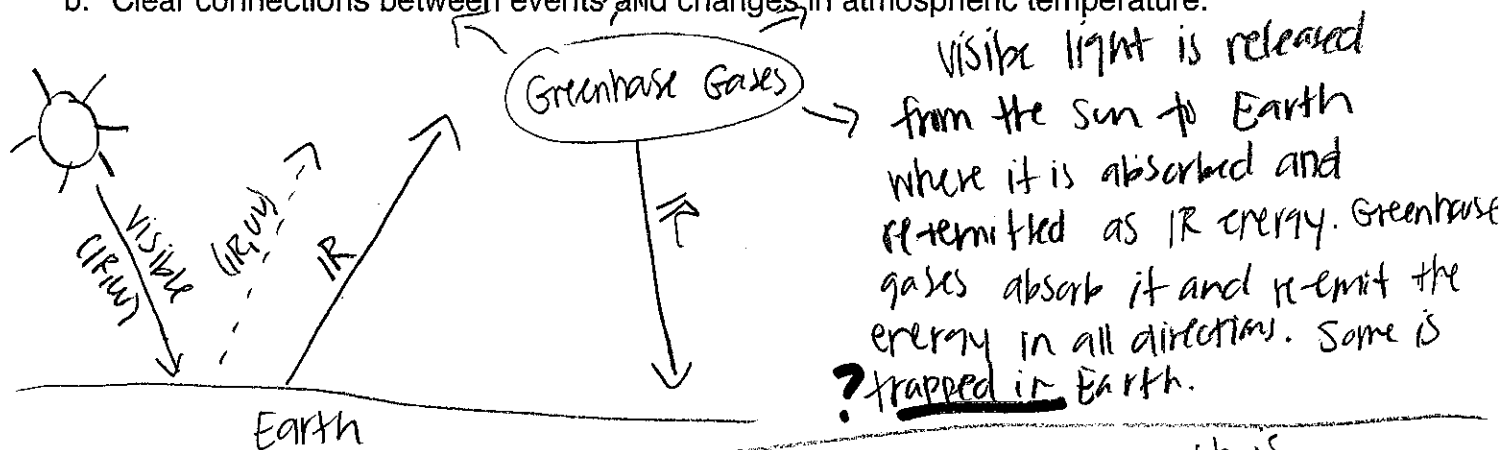
An increase in atmospheric carbon dioxide would affect ocean acidification because the carbon dioxide in the atmosphere and in the water are in equilibrium. Therefore, if there is more carbon in the air the oceans are going to become more acidic.

Since the atmosphere and the water are staying in equilibrium, it is positive feedback. If the temperatures were to fluctuate up and down, it may be considered negative feedback. }?

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.



If there is more volcanic ash in the sky then the ash is blocking the visible light that will be able to get through to Earth. If this continues to happen, Earth's temperature would decrease. While the sun is being blocked by the ash, greenhouse gases are still able to be produced so the Earth's atmosphere would still be warm.

22

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

During degassing, everything stays a gas. During evaporation, it goes from a liquid to a gas.

2

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

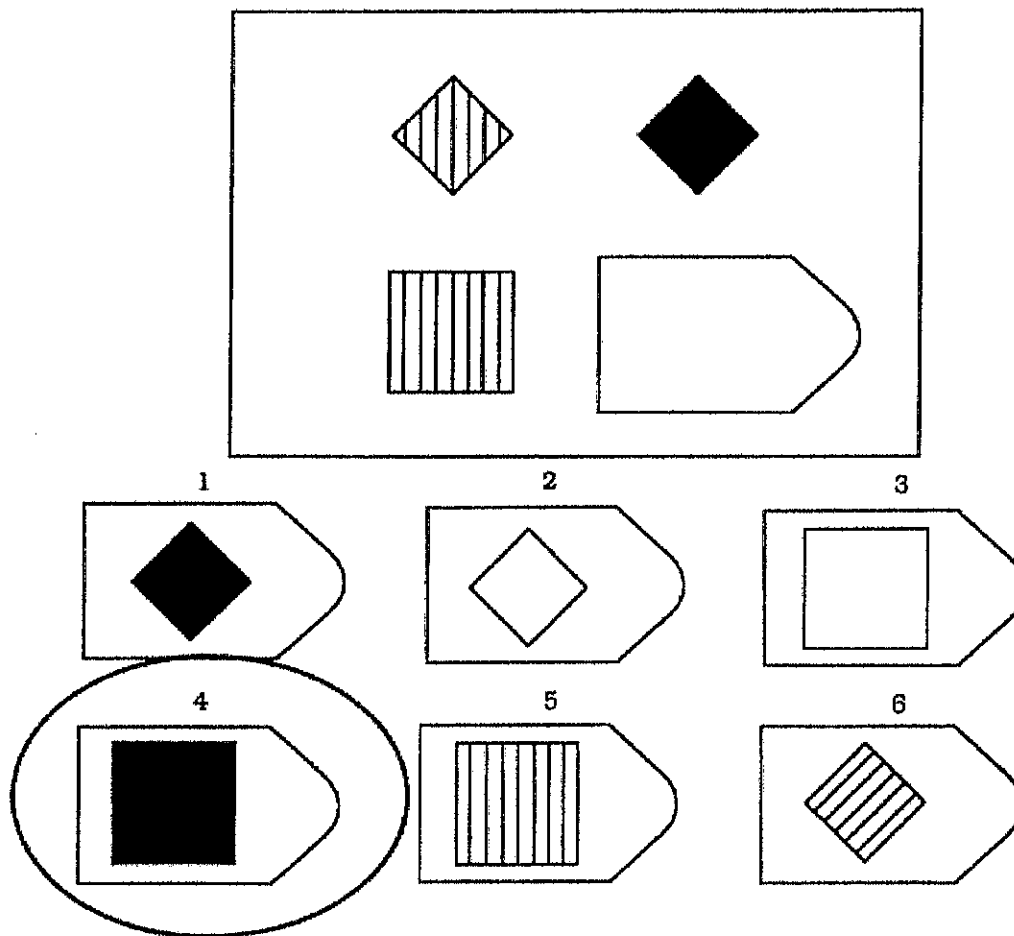
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

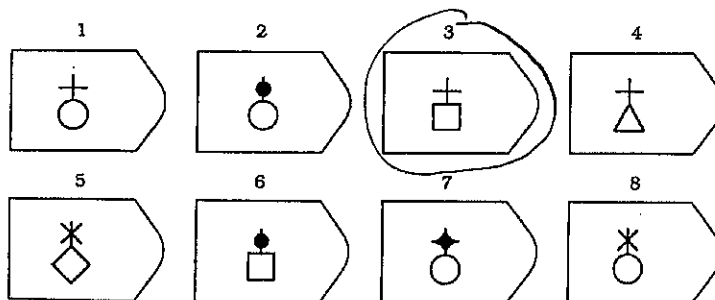
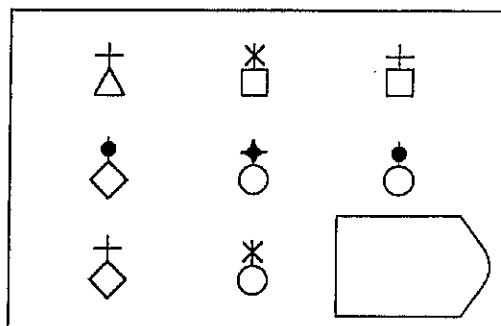


**Answer: 4**

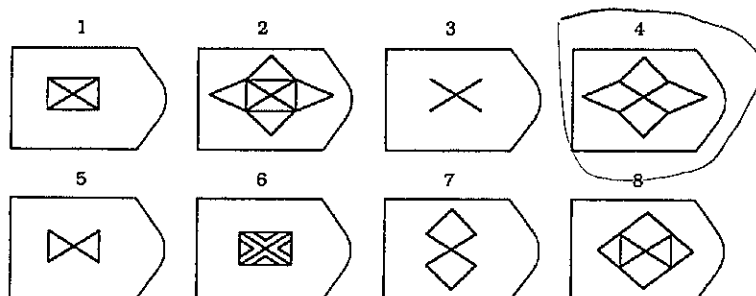
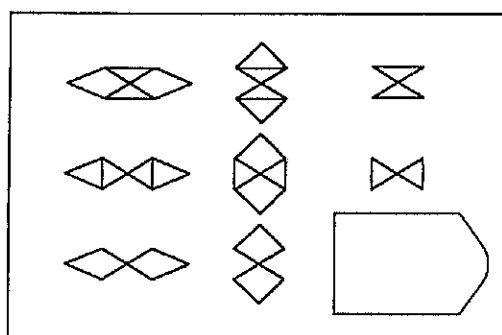
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Please choose the image that best completes each of the following patterns.

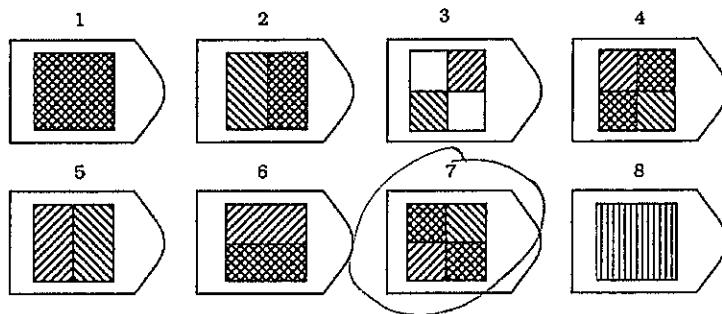
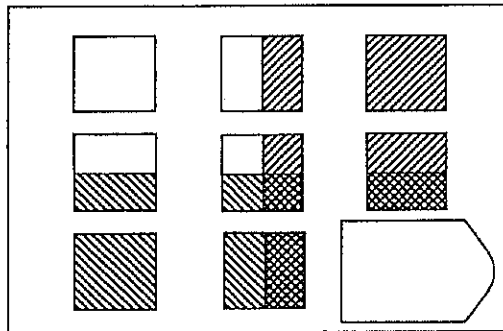
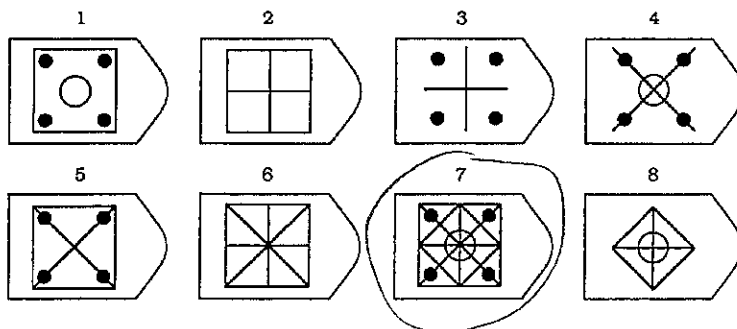
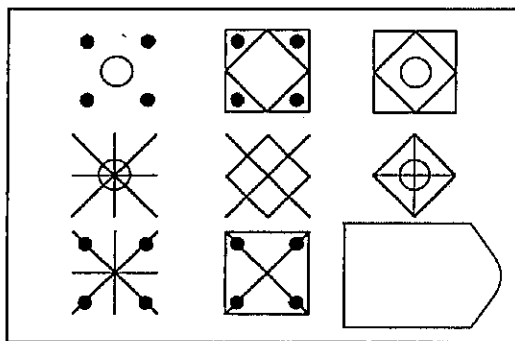
### PATTERN 1



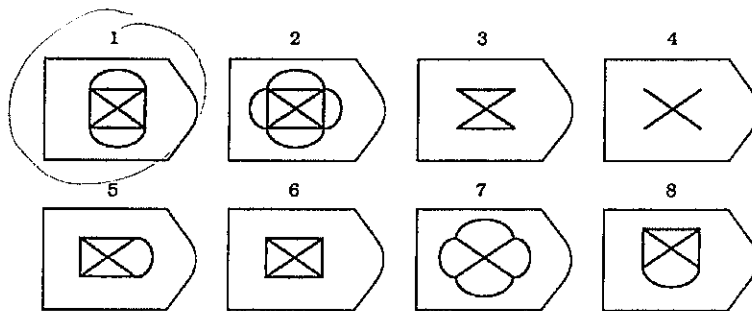
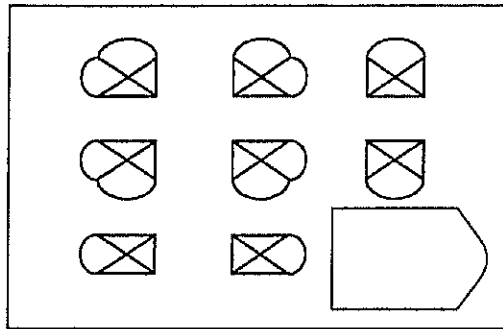
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - ☒ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - ☒ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48823

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☒ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A39963430  
Version A

GROUP: T2

87

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed + temp absorption
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere + temp + melt
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat + evap + cond
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A = erosion, B = deposition, C = uplift and erosion
  - ☒ b. A = erosion, B = biochemical precipitation, C = uplift and deposition
  - c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$RT = \frac{\text{amt in res}}{\text{total flux in/out}}$$

$$A = 400 \quad B = 200 \quad \text{rate} = 10$$
$$\frac{400}{10} = 40 \quad \frac{200}{10} = 20$$

influx/outflux  
of A + B are equal

$$RT = \frac{\text{amt in res}}{\text{total flux in and out}}$$

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

1. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
- b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.
- $\frac{1000}{100} = 10$  (I.F.)       $\frac{1000}{50} = 20$  (O.F.)
- outflow > inflow
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



SHORT ANSWER. 25 points each (50 points total)

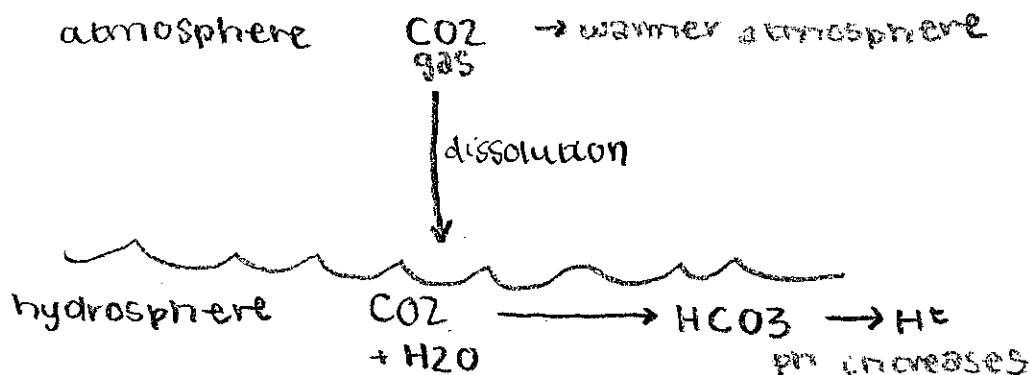
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

If the amount of  $\text{CO}_2$  in the atmosphere increased this would result in an increase in the amount of  $\text{CO}_2$  in the ocean. With the greater amount of  $\text{CO}_2$  in the ocean, there would be more interaction between the water and  $\text{CO}_2$  which causes bicarbonate & Hydrogen ions to form and create ocean acidity. Although the increase in  $\text{CO}_2$  in the atmosphere creates more  $\text{CO}_2$  in the oceans, the  $\text{CO}_2$  also rises the temperature in the atmosphere. This occurs because  $\text{CO}_2$  absorbs radiation and re-emits it back to Earth's surface causing temperatures to rise. With the increase in temperatures in the atmosphere, the ocean water becomes warmer as well. Because warm water absorbs less  $\text{CO}_2$  than cold water, the pH levels in the ocean would not be as strong as they would be if the water was colder. Overall, the ocean acidity would increase but just not as dramatically as they would if temperature was not a factor.



positive feedback

increased  $\text{CO}_2$  in atmosphere  
increased  $\text{CO}_2$  in ocean  $\text{H}_2\text{O}$   
more  $\text{CO}_2$  to react w/  $\text{H}_2\text{O}$  and create  $\text{H}^+$  ions  
increased ocean acidification

negative feedback

1. increased  $\text{CO}_2$  in atmosphere  
2. increased temps in atmosphere  
3. increases temps in ocean  $\text{H}_2\text{O}$   
4. warm water doesn't absorb  $\text{CO}_2$

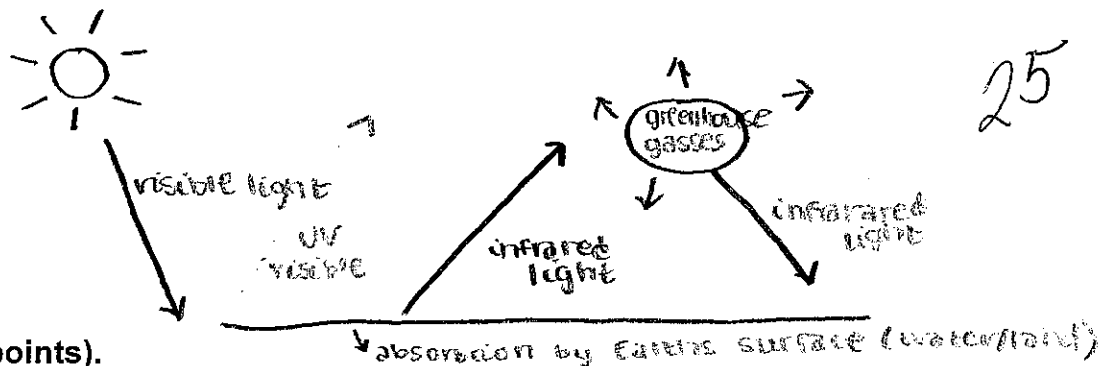
2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is a process in which visible light is radiated by the sun through Earth's atmosphere. Because molecules in the atmosphere (including greenhouse gasses) do not absorb visible light very easily, the visible light is radiated through the atmosphere and reaches Earth's surface. When it reaches the surface, the light can be reflected back into the atmosphere and back into space as visible light. When it reaches the surface, it can also be absorbed, transformed into infrared light and radiated back into the atmosphere as heat (in the form of IR light). Because molecules in atmosphere (greenhouse gases) easily absorb infrared light, this light is able to be absorbed and re-directed back towards Earth's again - a system that allows heat to be "trapped".

If volcanism increased dramatically, the Earth's atmosphere could be affected in different ways. With the large eruptions of ash clouds in the atmosphere from the volcanoes, less of the light radiated from the sun would be able to reach Earth's surface and transformed into heat. This could cause a cooling effect in our atmosphere. Along w/ the ash, however, volcanoes emit large amounts of CO<sub>2</sub> into the atmosphere which cause temperatures in our atmosphere to increase. In a matter of years, the ash clouds could settle out and more light could reach Earth's again which could cause global temperatures to increase.



2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

evaporation is when water in the liquid form is transformed into gas in the atmosphere but degassing is when gas in a liquid becomes gas in the atmosphere (CO<sub>2</sub> in ocean degasses & becomes CO<sub>2</sub> in atmosphere)

Earn up to 1 additional point on your course grade

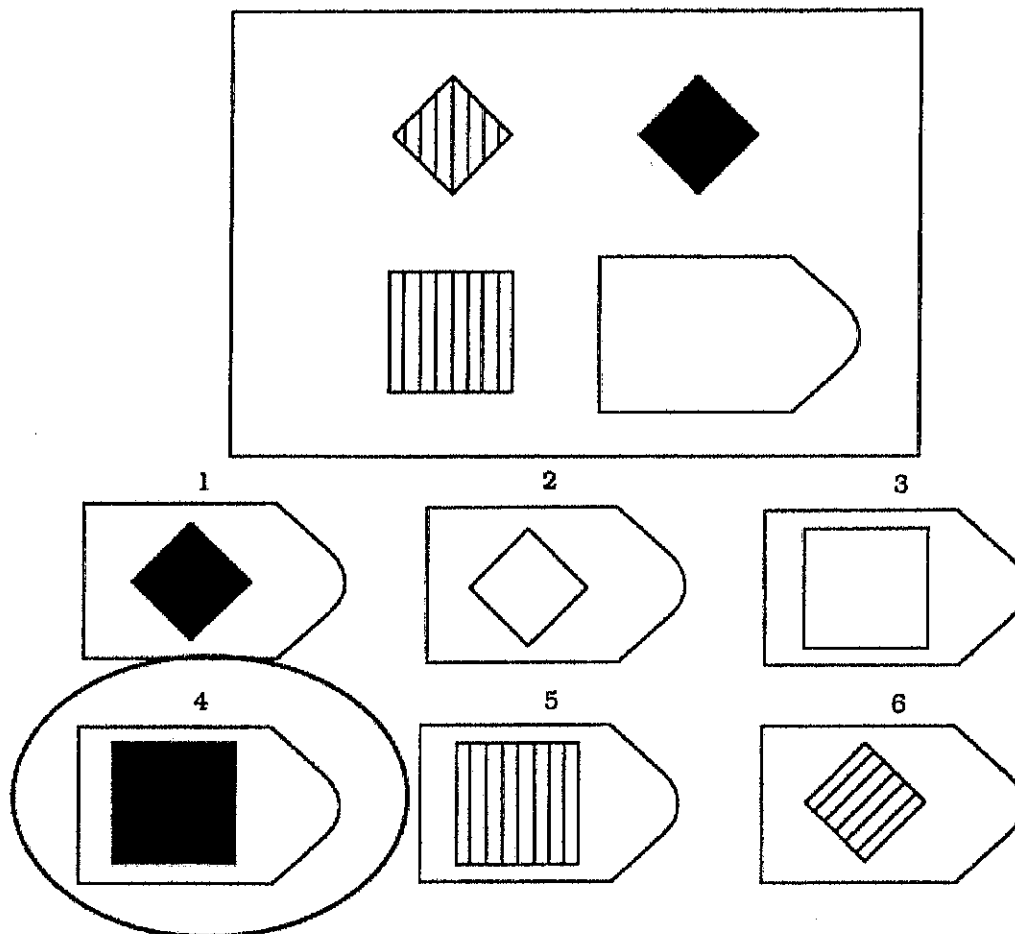
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

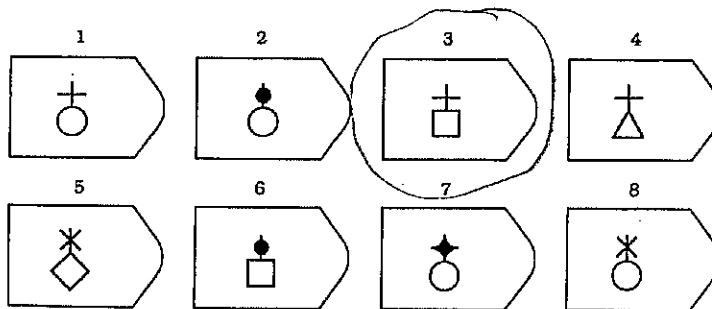
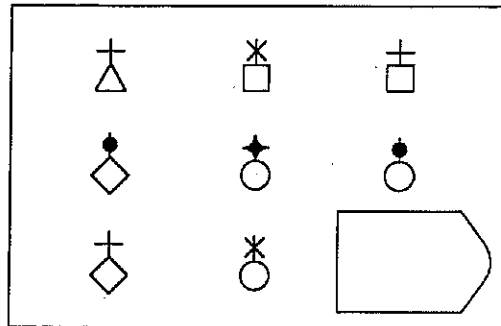


**Answer: 4**

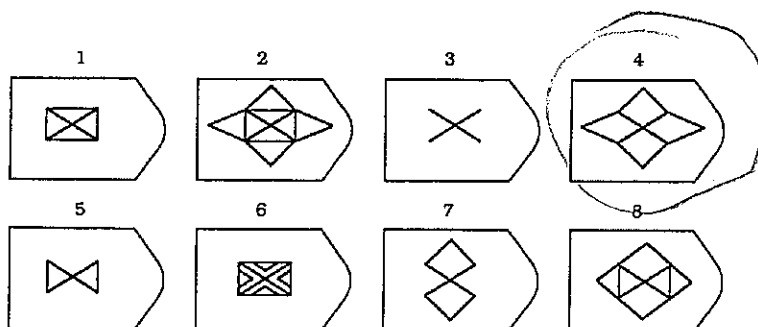
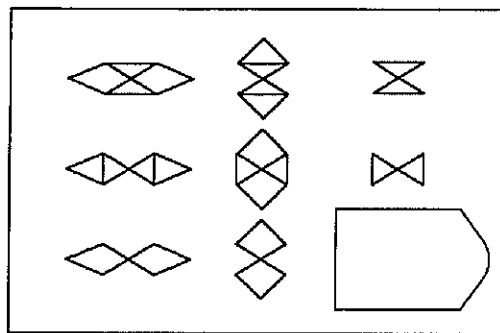
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

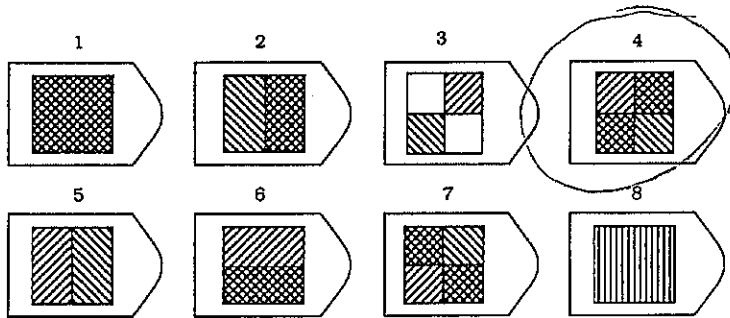
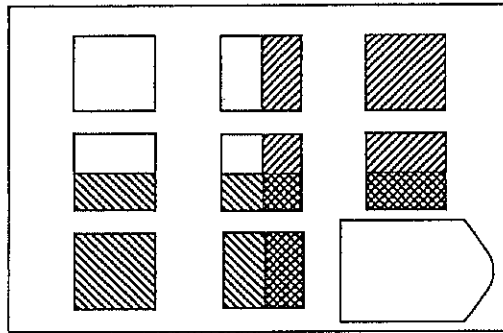
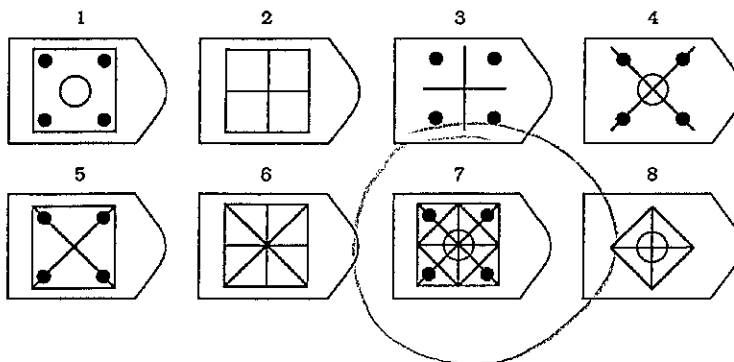
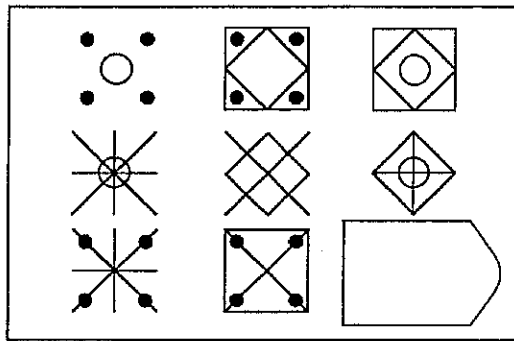
### PATTERN 1



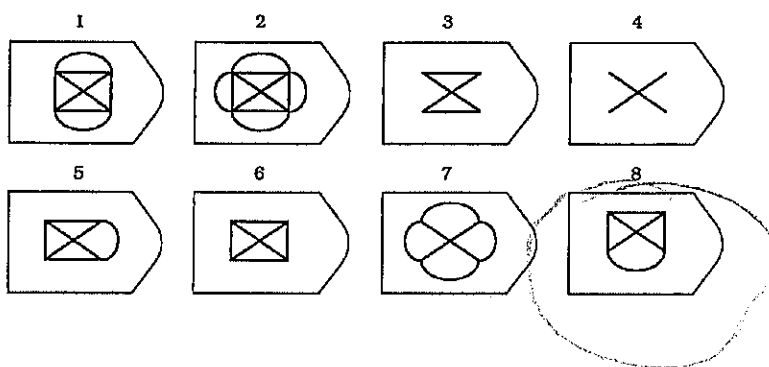
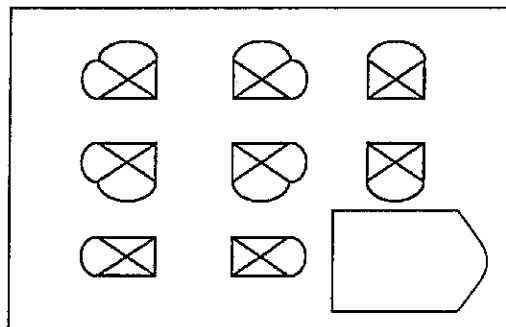
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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  - B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
  - A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
  
3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.
  - ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
  
4. The rival gangs used graffiti to define their territorial boundaries.
  - A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE



5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48888

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A40290629  
Version A

GROUP T2

75

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- B** 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ~~a.~~ The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ~~d.~~ Crystals forming in the magma
- C** 2. Which of the following would be considered a negative feedback to increasing global temperature?
- ~~a.~~ Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ~~b.~~ Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ~~d.~~ An increase in desert formation resulting in more dusting blowing into the atmosphere
- C** 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- A** 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect. burning coal
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- A** 5. Which of the following would cause the acidity of Earth's oceans to decrease? cold, holds more carbon
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- B** 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- B = equal  
A = equal

A 10/100 35000  
100 100  
2 5

- B** 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true? 1000
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- A** 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B** 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- D** 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

*less carbon in atmosphere*

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

$\text{CO}_2$  in the atmosphere and  $\text{CO}_2$  in the water must reach equilibrium.

$\text{CO}_2$  atmosphere  
equilibrium  
 $\text{CO}_2$  water

An increase in atmospheric carbon dioxide would increase the acidity of the ocean because more  $\text{CO}_2$  with  $\text{H}_2\text{O}$  equals more acidity. Cooler water holds more carbon, but the more carbon equals hotter temperatures, explain resulting in negative feedback. Negative feedback happens when an event happens (temperature decreases) and the reaction is that it goes in the opposite direction (temperature increases). Positive feedback is when an event or change happens (temperature increases) and the change goes in the same way (temperature continues to increase) if carbon continues to increase, so will atmospheric and ocean temperatures.

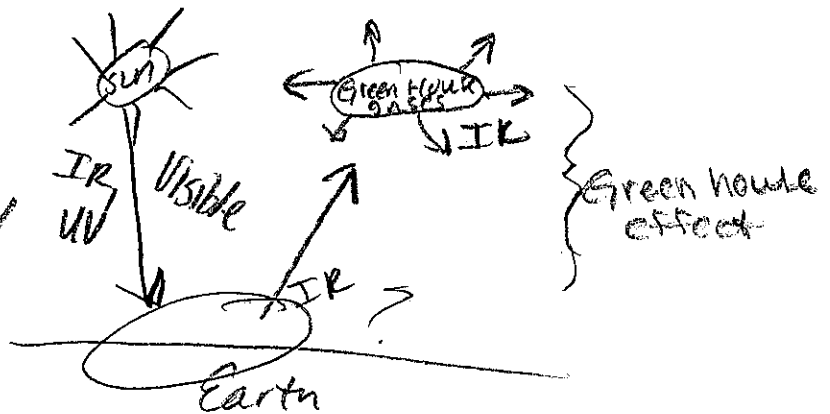
$\text{CO}_2 + \text{H}_2\text{O} = \text{acidity}$   
Ocean acidification

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The ash cloud would reflect any solar radiation from coming into the atmosphere, however, it would also trap infrared light in the atmosphere.



Greenhouse gases would still absorb the IR and reemit it back in the atmosphere, heating earth up, still. Although the ash cloud would cool earth down because no visible light is entering, Carbon is still in the atmosphere & is going through global warming, resulting to an increase in temperature. Once the ash cloud is gone, visible light will come back into the atmosphere, resulting in more carbon being absorbed by greenhouse gases and an increase in temperature. (Once the visible light is absorbed by earth, some infrared heat is reflected into outside of the atmosphere) (side note for greenhouse effect)

un clear

18

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are different because degassing is carbon dioxide moving from water into the atmosphere. Evaporation is changing a liquid into gas.

Earn up to 1 additional point on your course grade

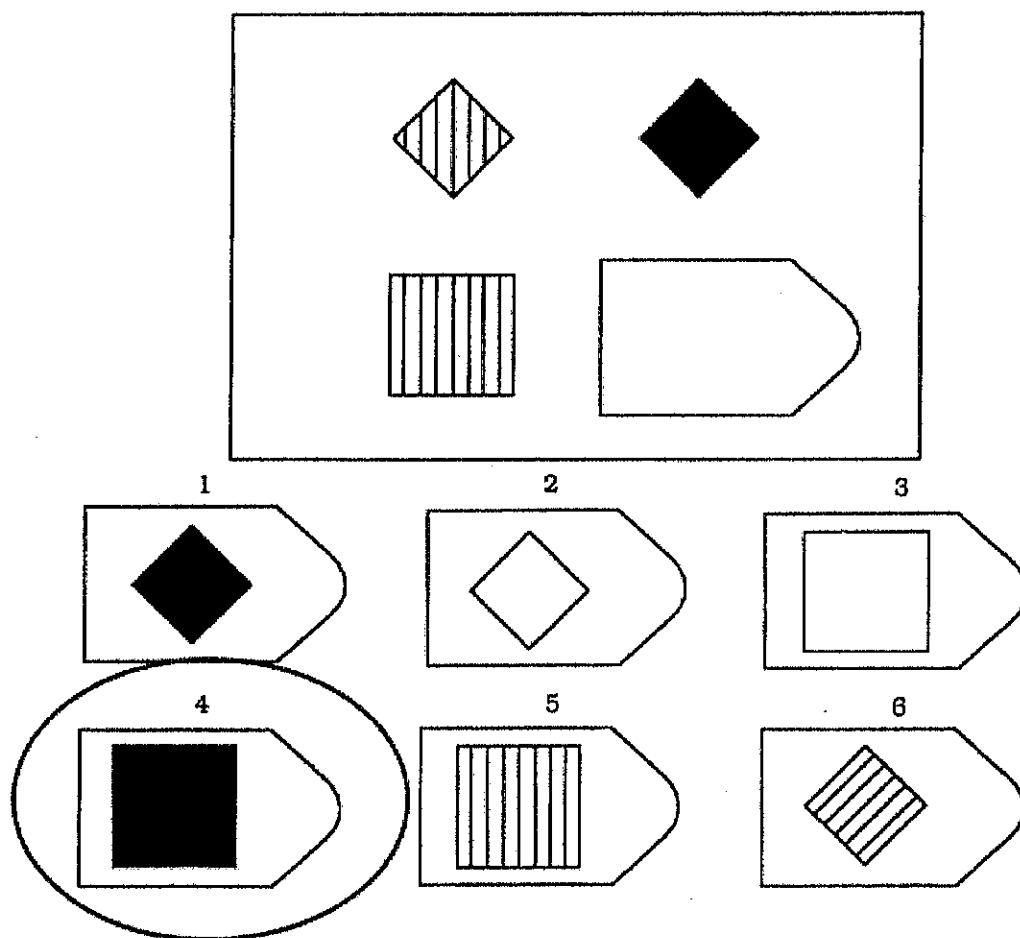
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

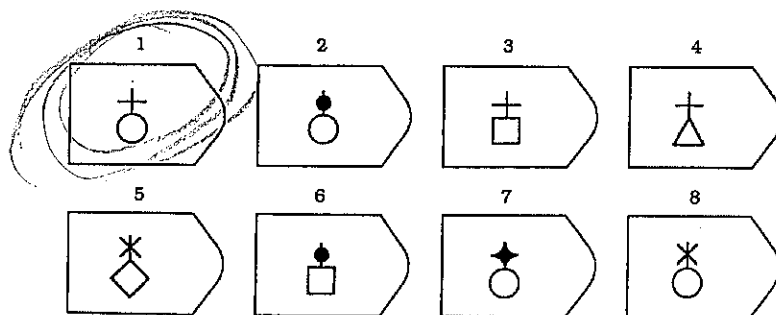
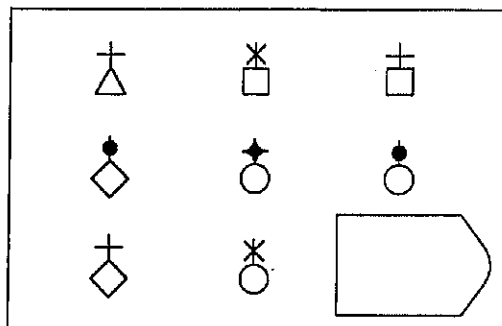


**Answer: 4**

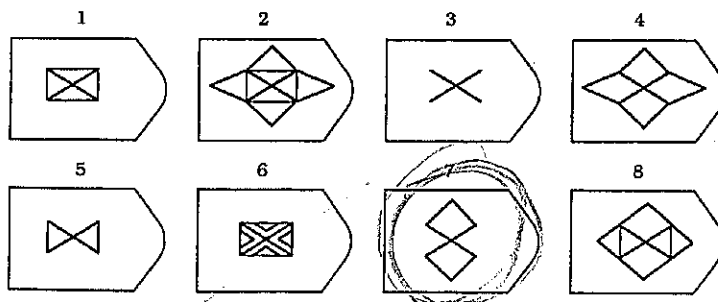
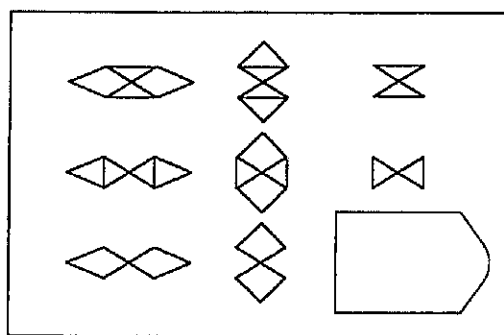
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1



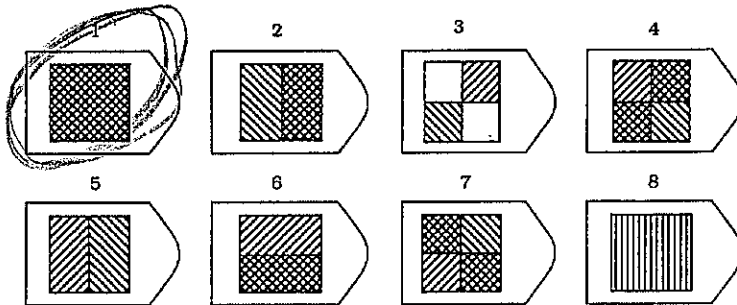
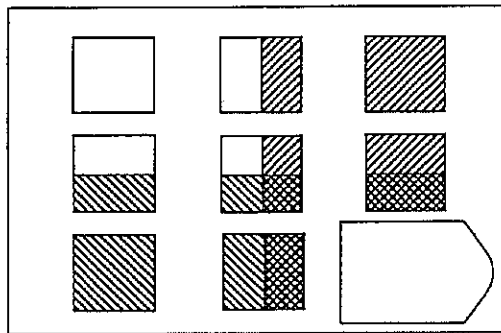
### PATTERN 2



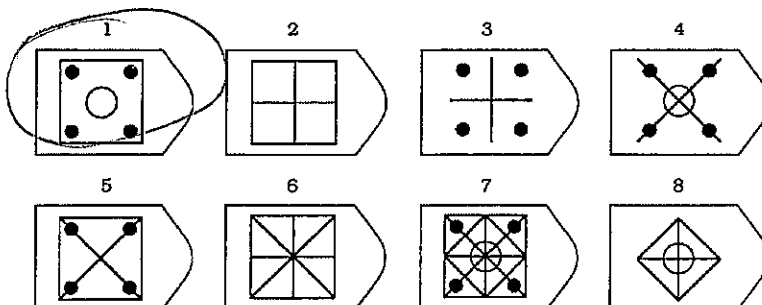
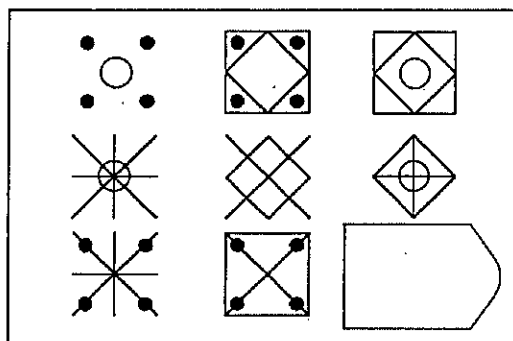
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## PATTERN 3



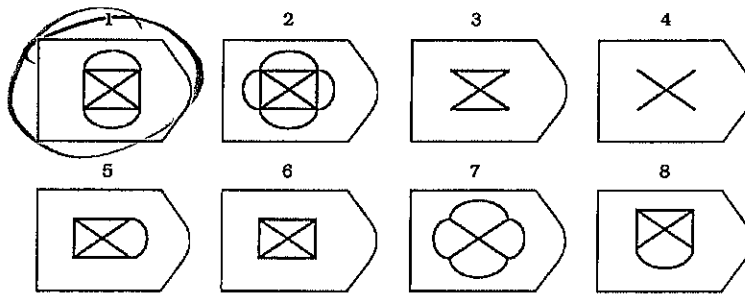
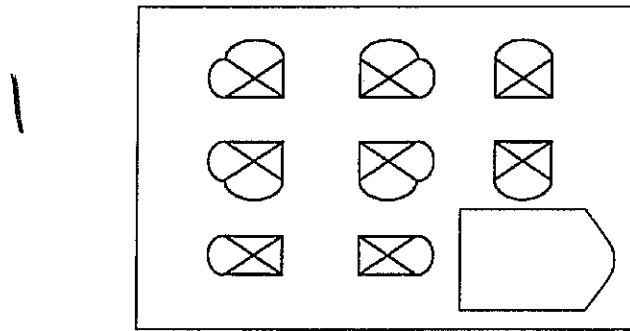
## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

A400906029

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

- C 1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.
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  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
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  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
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  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - ~~D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.~~
- C 4. The rival gangs used graffiti to define their territorial boundaries.
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  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

- C** 5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ~~A.~~ The plumber fixed the pump that had burst and flooded the basement.
- B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
- C.** The groom's mother mended her son's tuxedo since he had torn a hole in it.
- D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

- A** 1. A balloon floating is like...
- A.** An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- ~~D.~~ A cloud in the sky. They are similar because they both float and are carried by the wind.
- B** 2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
- B.** Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48823

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A43979706  
Version A

GROUP T2

63

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder X
  - ☒ b. Gas bubbles forming in the magma ✓
  - c. The surrounding crust becoming hotter ✓
  - d. Crystals forming in the magma X

☒ 2. Which of the following would be considered a negative feedback to increasing global temperature?

- C
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat ✓
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere

C

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- a. A= erosion, B= deposition, C= uplift and erosion
- b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- d. A = dissolution, B= deposition, C= uplift and deposition

☒ 4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- A
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.

A

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide. ✓
- b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
- c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

B

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- a. Reservoir A has a shorter residence time than Reservoir B.
- ☒ b. Reservoir B has a shorter residence time than Reservoir A. ✓
- c. Reservoir A and Reservoir B have equal residence times.
- d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

B

- a. The reservoir will eventually disappear. 1000  
b. The reservoir is not in equilibrium. ✓  
c. The reservoir is growing smaller.  
d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

A

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease ✓  
b. Reflection of more solar radiation, causing atmospheric temperature to increase ✓  
c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase ✗  
d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease ✗

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

B

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature. ✓  
c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature. ✓  
d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature. ✗ ?

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

D

- a. The Earth's atmosphere would become colder than it is today.  
b. The Earth's atmosphere would become warmer than it is today. ?  
c. The Earth's atmosphere would remain about the same temperature as it is today.  
d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same. ✓

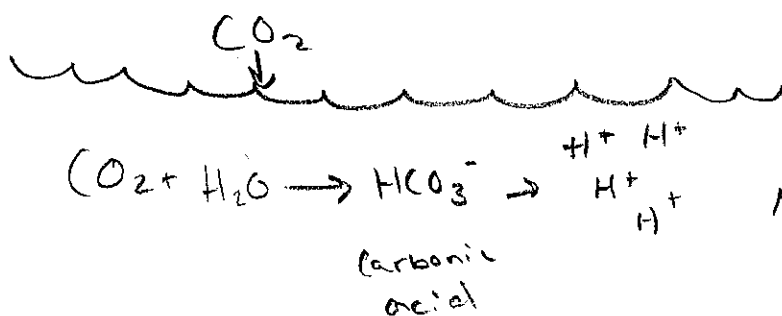
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean Acidification is the process of the ocean dissolving  $\text{CO}_2$ , therefore causing an increase in the production of carbonic Acid. This creates more  $\text{H}^+$  ions in the ocean, making the Ocean more acidic.



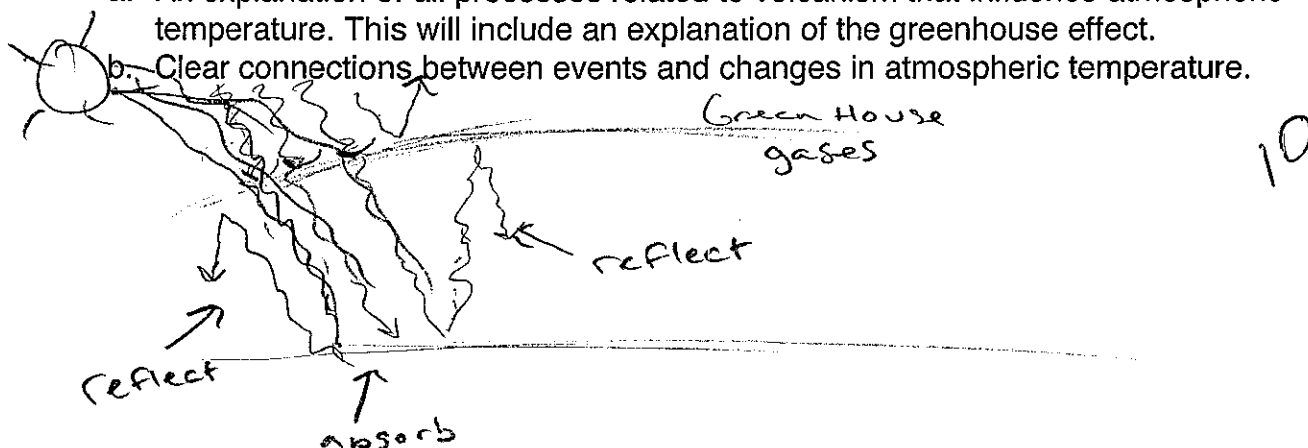
The more  $\text{H}^+$  ions in the water the more acidic the water becomes

This could be viewed at as a positive feedback loop because the more acidic water will be evaporated causing an increase in  $\text{CO}_2$  in the atmosphere / water vapor, which would cause the ocean to dissolve more  $\text{CO}_2$ . This would increase the amount of  $\text{CO}_2$  more and more as a microphone does when it picks up its own feedback. Negative feedback occurs when something counteracts the exponential increase of a product. An example of negative feedback in ocean acidification is the regulation of  $\text{CO}_2$  entering the water through efforts to decrease  $\text{CO}_2$  emissions.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.



Greenhouse effect - when visible light from the sun reaches the Earth's surface, some light is absorbed by (clouds, water, and the Earth's crust). Other ~~light~~ <sup>light</sup> reflects off of these surfaces back into the atmosphere, but are trapped by  $\text{CO}_2$ , methane, other wise known as greenhouse gases. This causes an increase in infrared radiation <sup>resulting</sup> in an increase of temperature. ~~NO~~

An increase in volcanism and the ash that results from it would cause a decrease in the visible light that would enter Earth's atmosphere, resulting in a decrease in reflection off of the Earth's surface, therefore decreasing infrared radiation. With less infrared and ultra violet radiation, a decrease in Atmospheric temperature would result until more volcanic ash dissipates.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?



Earn up to 1 additional point on your course grade

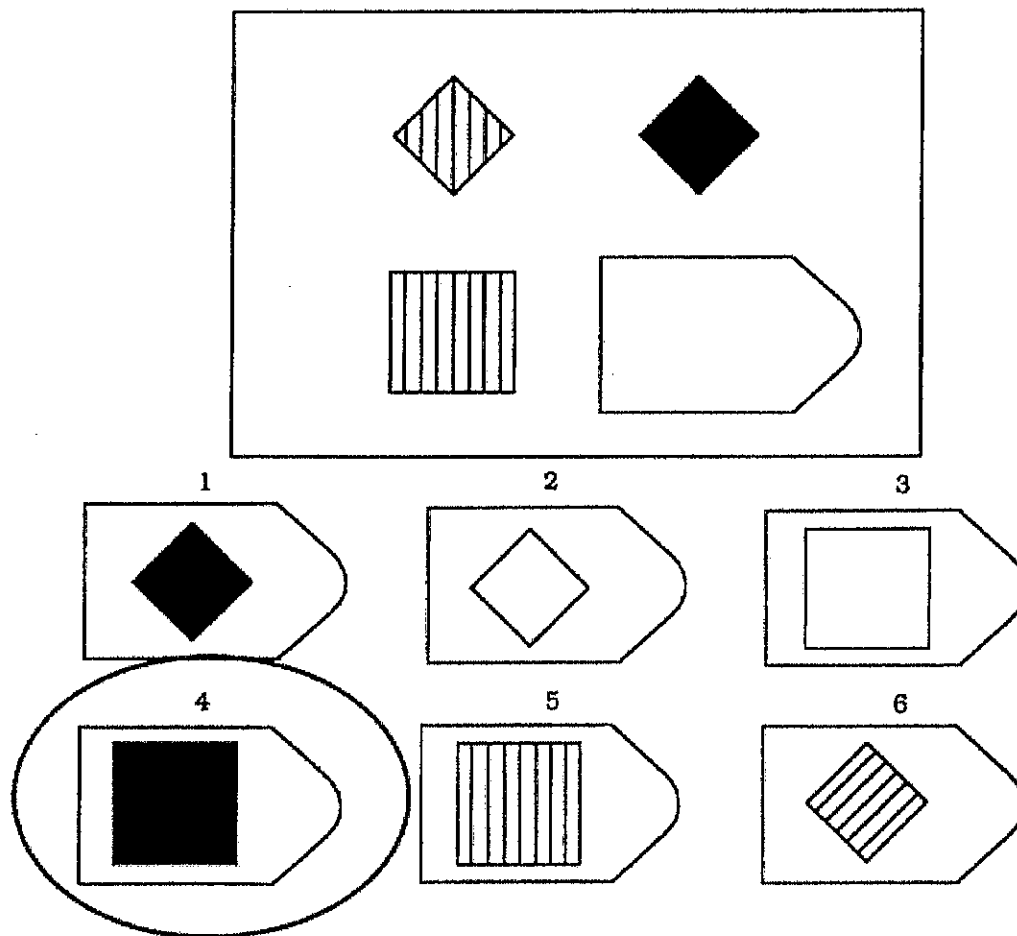
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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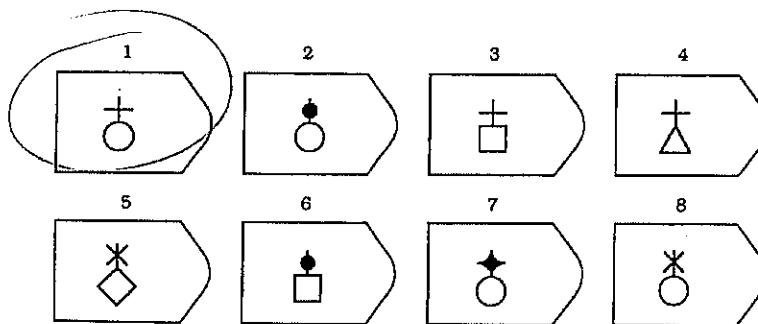
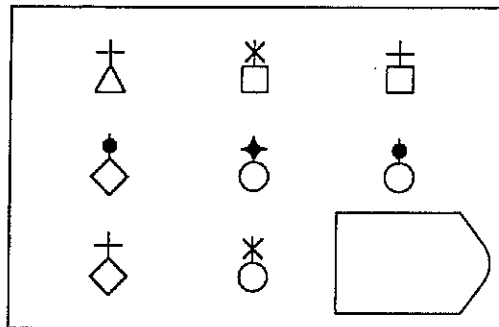


**Answer: 4**

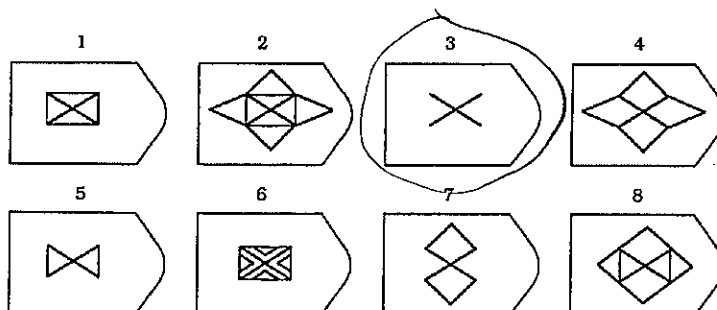
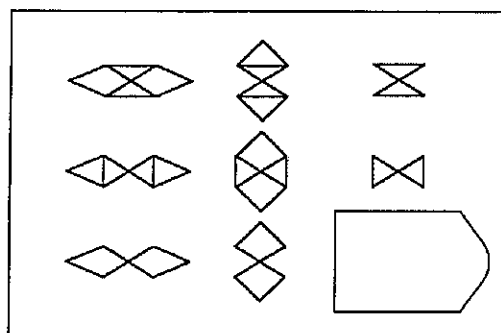
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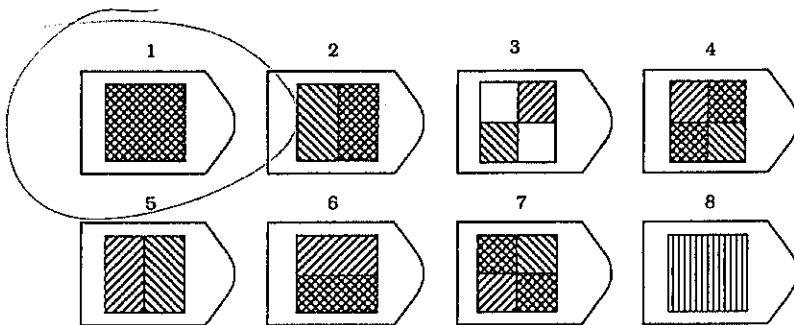
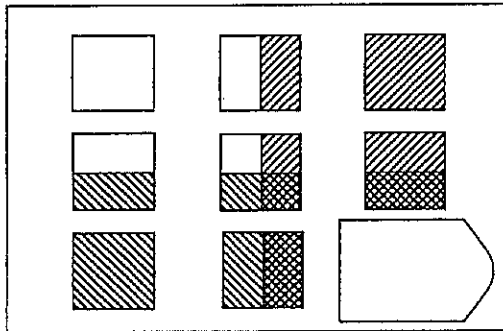
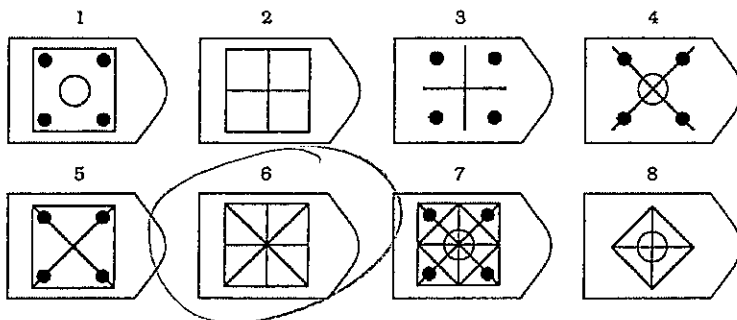
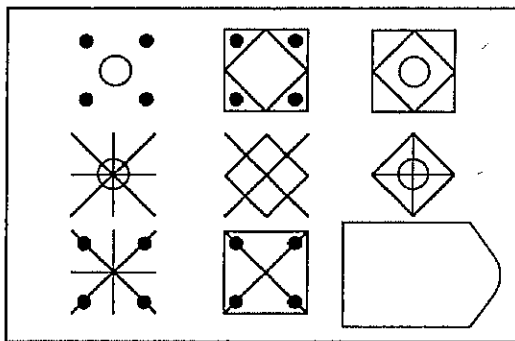
### PATTERN 1



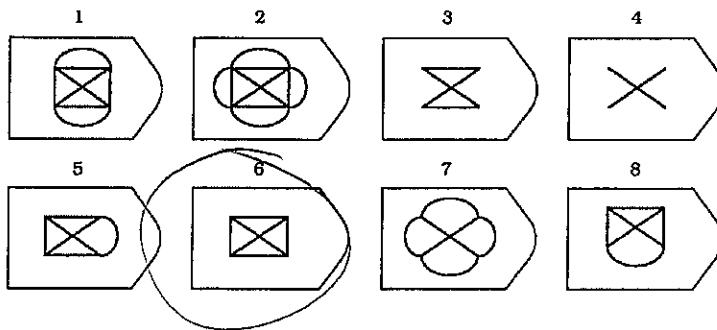
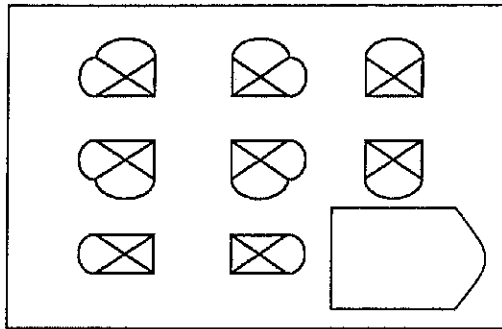
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

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**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

**Please choose the best analogy to each of the following statements.**

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2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

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*PLEASE CONTINUE ON NEXT PAGE*

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
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Please choose the response that is closest to an analogy that you might make.

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- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
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  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 77095

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42226052  
Version B

GROUP: T3

68

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- ✓ 1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- ✓ 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
- ✓ 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- ✓ 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
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- ✓ 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

Influx of A & B are =
- ✓ 6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

cold temp = can hold more CO<sub>2</sub>



7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium. *Boz*
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric ~~temperature is increasing~~. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

- Ocean acidification refers to the change in the pH of the oceans due to the amount of  $\text{CO}_2$  in the ocean.
- An increase in atmospheric  $\text{CO}_2$  means that there will be an increase in the amount of  $\text{CO}_2$  in the oceans increasing ocean acidification.
- This could be an example of ~~po~~ a positive feedback loop because an increase in atmospheric carbon dioxide could ~~be~~ mean an increase in global temperature. An increase in global temperature can also increase the temperature of the ocean ~~quickening~~ the ocean acidification process.
- An increase in atmospheric  $\text{CO}_2$  can also be an example of <sup>a</sup> negative feedback loop because an increase in  $\text{CO}_2$  means that there could be an ~~increase~~ <sup>increase</sup> in greenhouse gases. This can increase global temperature and <sup>can</sup> cause evaporation to occur. Evaporation can form clouds blocking radiation from the sun cooling the oceans. Even though the ~~cooler the~~ <sup>cooler the</sup> ocean temperatures can hold more gases, the process to transform  $\text{CO}_2$  into carbonic acid will take longer.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

20

• If large ash clouds covered the Earth's atmosphere, this would increase the greenhouse effect substantially.

• The greenhouse effect occurs when the sun's radiation enters the atmosphere. Some of the visible light is absorbed into Earth's surface and ~~it~~ is re-emitted as infrared light, or some of it is reflected back into space. The infrared light is "trapped" <sup>How?</sup> inside the atmosphere when it re-emits increasing global temperature. This is essentially the greenhouse effect.

• The greenhouse gases being emitted due to the volcanism builds up in the atmosphere. The ashes will block the sun's radiation. Earth's temp. at this time will decrease slightly but as soon as the ashes settle, earth's temperature will skyrocket. ~~be~~ This is because there is an extremely high amount of greenhouse gases so when the Sun's radiation is able to enter Earth's atmosphere again, more of the infrared light/heat will be trapped? increasing Earth's atmospheric temp. in the long run.

1

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar because they both deal w/ liquid + gas. They are different because evaporation is the transformation of a liquid turning into a gas whereas degassing is the movement of a gas out of a liquid.

Earn up to 1 additional point on your course grade

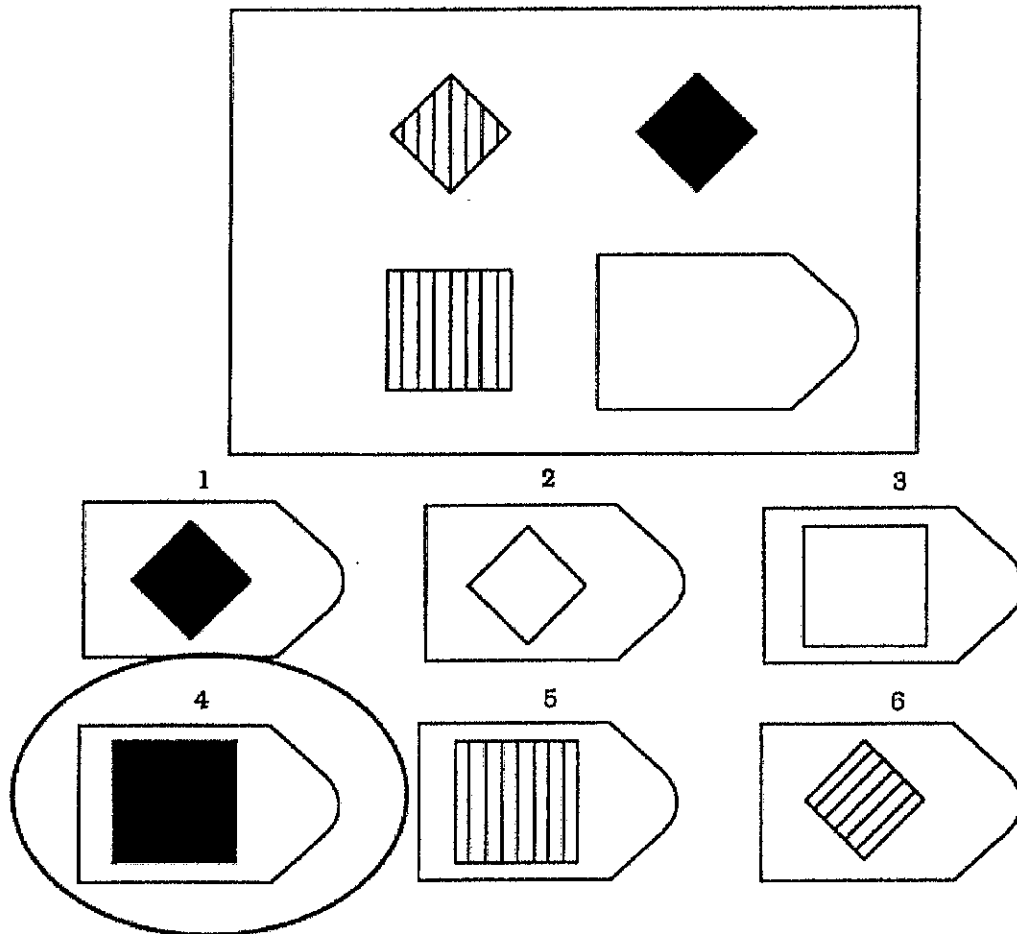
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

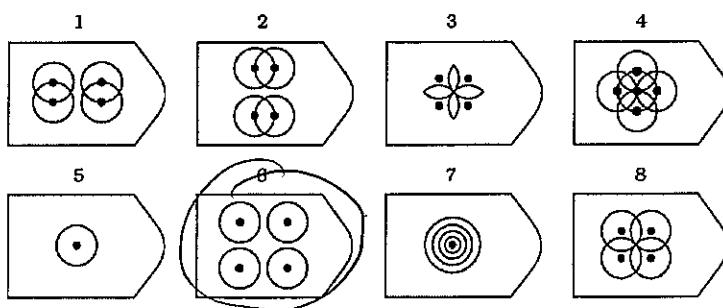
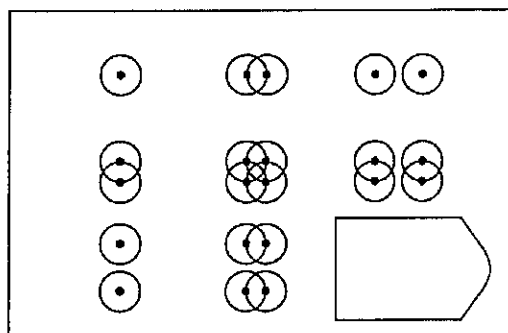


**Answer: 4**

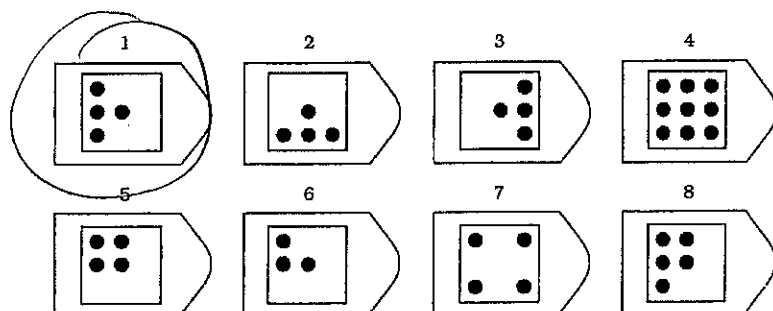
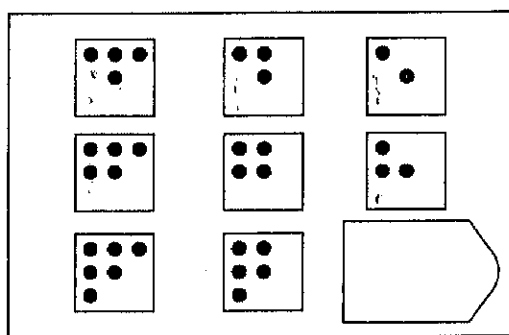
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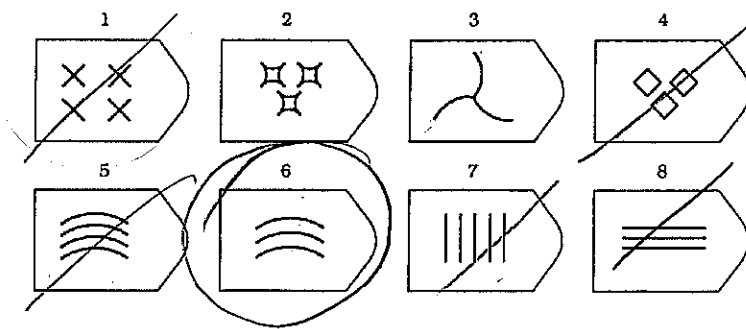
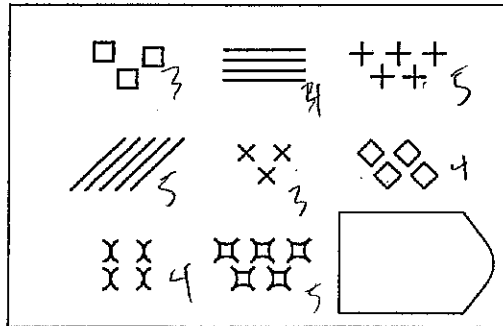
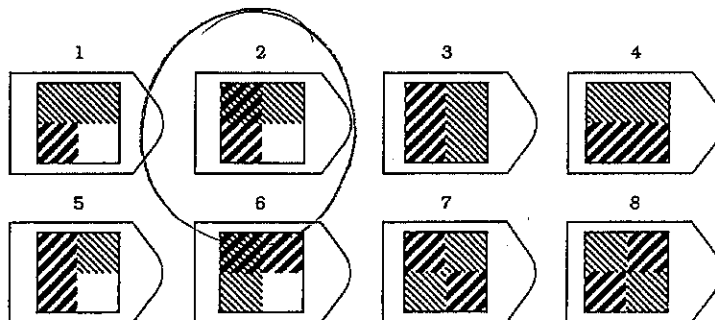
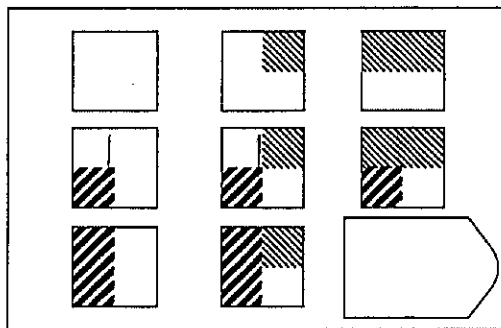
Please choose the image that best completes each of the following patterns.

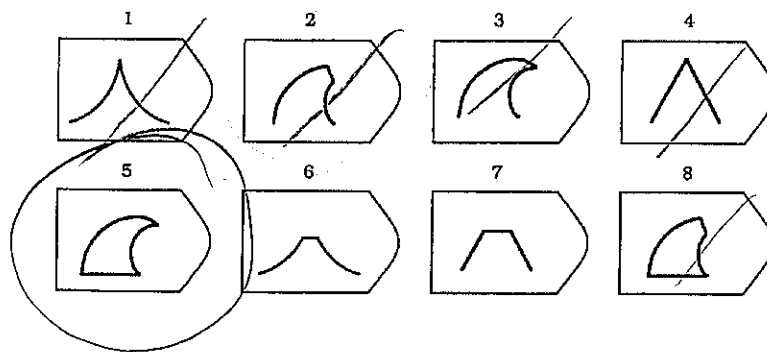
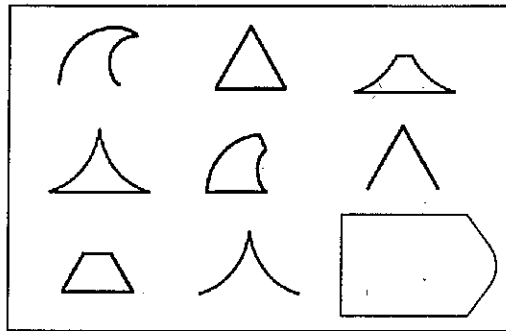
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

☒ D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

☒ B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

☒ D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49024

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☐ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☒ Other

I went to your  
office hours beforehand ;)

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME:

A42741352

Version B

GROUP:

T3

A42741352

73

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed ~~X~~
  - Melting of permafrost resulting in more methane escaping into the atmosphere ~~X~~
  - An increase in evaporation and cloud formation resulting in the release of latent heat ~~X~~
  - ☒ An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder ~~X~~
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter ~~X~~
  - Crystals forming in the magma ~~X~~
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion ~~X~~
  - A = erosion, B = biochemical precipitation, C = uplift and deposition ~~X~~
  - A = dissolution, B = biochemical precipitation, C = uplift and erosion ~~X~~
  - ☒ A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect. *We (humans) have just increased*
  - ☒ Natural processes are the primary cause of the greenhouse effect. *It's more than without our emissions*
  - Human activities and natural processes are roughly equal causes of the greenhouse effect. *Since Industrial Revolution*
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- $RT = \frac{\text{Size}}{\text{Flux}}$
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- This is because if ocean temperature goes up, less carbon can be dissolved*
- ☒ An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B*
- a. The reservoir will eventually disappear. ~~x~~
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller. ~~x~~ *bigger*
  - d. The reservoir's residence time is 10 years. ~~x~~

$$100 \neq 50$$

$$10 \neq 0.1$$

~~7.~~ What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A*
- a. The Earth's atmosphere would become colder than it is today. *Depending on the Climate Cycles and the Slow dissipation of Carbon*
  - ☒ b. The Earth's atmosphere would become warmer than it is today. *from emissions, after some time with all variables stable from feeding emissions, less carbon*
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same. *World mean a cooler temperature*

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A*
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase ~~x~~
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease ~~x~~

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B*
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature. ~~x~~
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature. ~~x~~
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature. ~~x~~

**SHORT ANSWER. 25 points each (50 points total)**

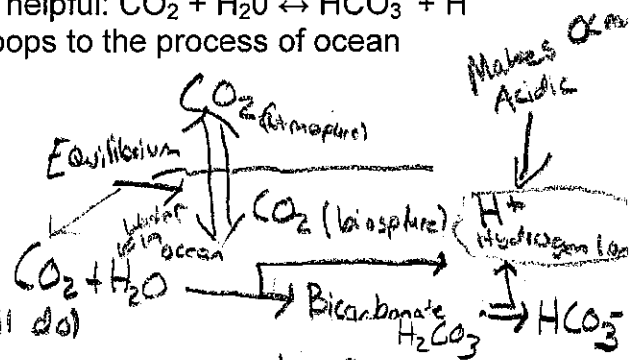
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a. When there is an increase of  $\text{CO}_2$  in the atmosphere, there will also be an increase in the hydrosphere because they both remain in equilibrium with one another. (If one carbon reservoir increases, they all do)

This results in an increased amount of  $\text{CO}_2$  in the hydrosphere. When the  $\text{CO}_2$  enters the hydrosphere, it will bond with water to form  $\text{H}_2\text{CO}_3$  and may occasionally release  $\text{H}^+$  ions. During this step, as indicated by the 1.65 billion year point masses for the ocean acidification week, which I've recreated to the best of my abilities above. This  $\text{H}_2\text{CO}_3$  will either remain as it is, or break down to  $\text{HCO}_3^-$  and more  $\text{H}^+$ . To sum this up, the more  $\text{CO}_2$  in the atmosphere, the more in oceans which leads to more  $\text{H}^+$  (hydrogen ions). The hydrogen ions are acidic, and as their amount grows, so does the ocean acidity.



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**Negative Feedback:** Because of the increase in  $\text{CO}_2$  which resulted in a more acidic hydrosphere, plants and some sea life will die due to sensitivity to the pH.  $\downarrow$

**Positive Feedback:** The Dead Sea <sup>(exoskeletons)</sup> life will leave bicarbonate which can break down to form  $\text{HCO}_3^-$  and  $\text{H}^+$ , the  $\text{H}^+$  of which will continue to additionally raise the oceans acidity.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

*Green House Effect: Green house Gasses are a natural process that occurs when the earth's atmosphere "Traps" Infrared energy. Most visible light reaches the earth's surface. Some of the visible light is (reflected or re emitted) as IR Energy. There is also some IR Energy straight from the sun that is reflected or re emitted. Greenhouse Gasses "absorb" that IR energy and will reflect and re emit that IR in every direction.*

*There is also the processes of density/buoyancy which help dry the ash upward.*

*Lastly, there is the idea of a plate boundary, for example, ocean-continent convergent which is a possible site for this volcano and its ash to rise from*

*b. We are unable to definitively say whether the earth's atmospheric temperature will increase or decrease; However, we can predict some major events as a result from the volcano. The ash clouds would redirect IR from the sun away from the earth. It would also keep out IR Energy from escaping to space. While this ash cloud would have some  $H_2O$  mixed with it's  $CO_2$ , it lacks methane gas. However, you should consider it to be like Green house gasses.*

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Extra credit (2 points).

How are evaporation and degassing similar and/or different?

*Both evaporation & degassing deal with matter whose density is changing (degassing has compression) and both move it to escape to a place of density equilibrium. However, because evaporation deals with water, it has a much higher latent heat of vaporization than degassing.*

Earn up to 1 additional point on your course grade

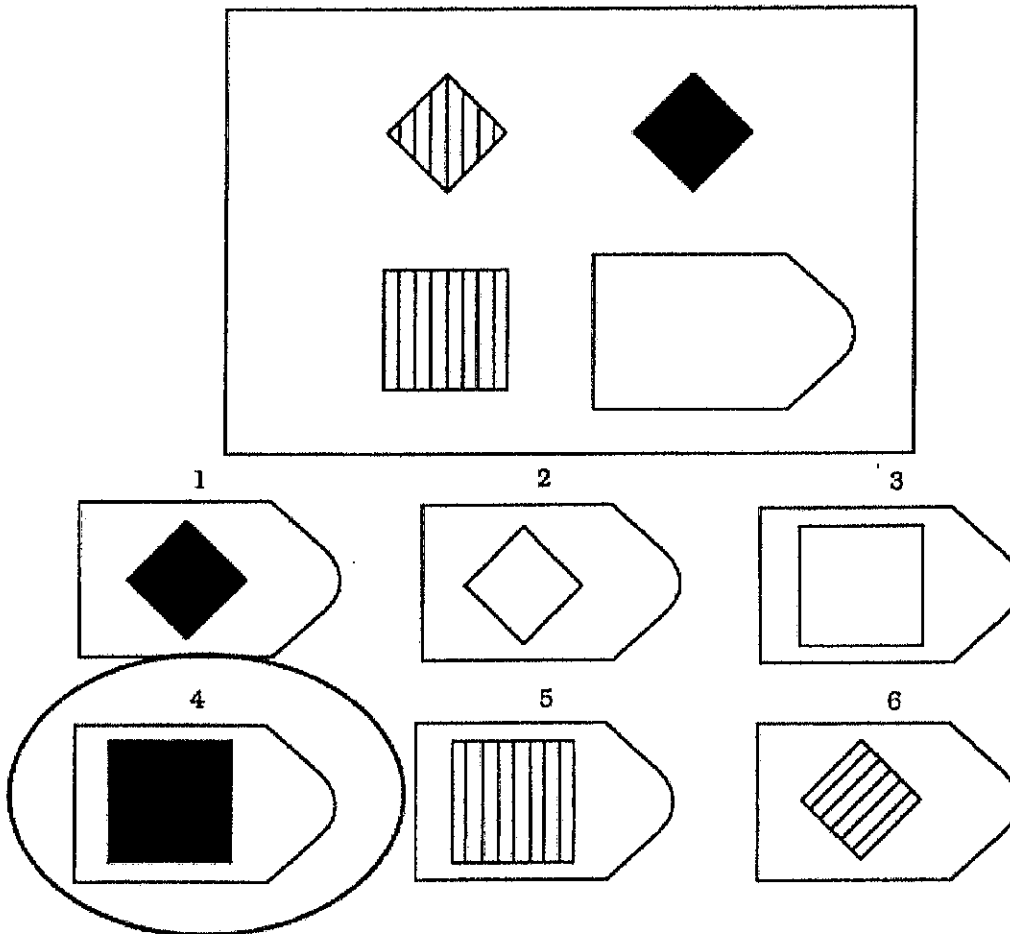
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



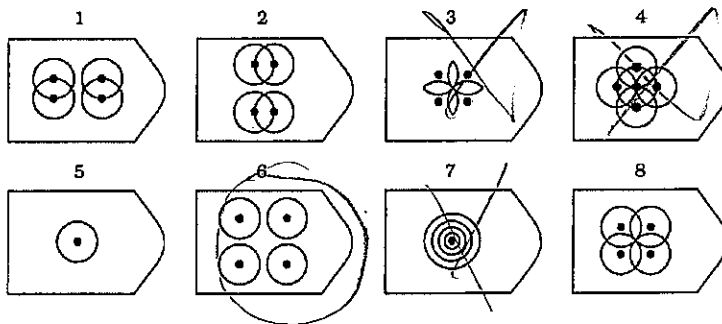
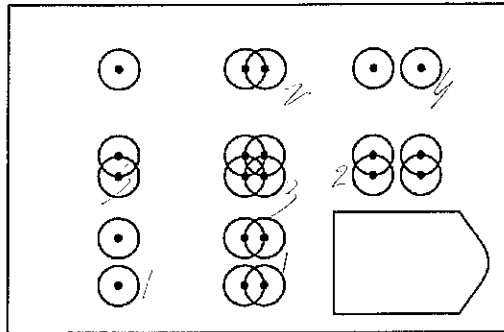
**Answer: 4**

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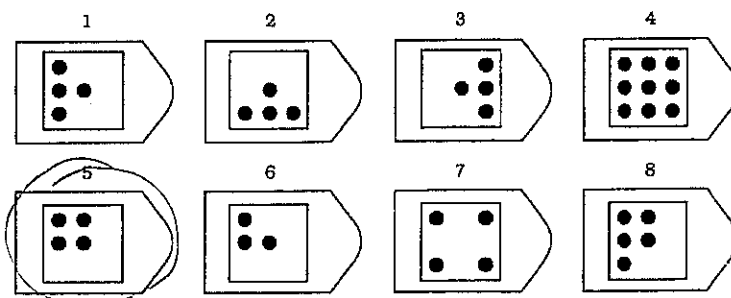
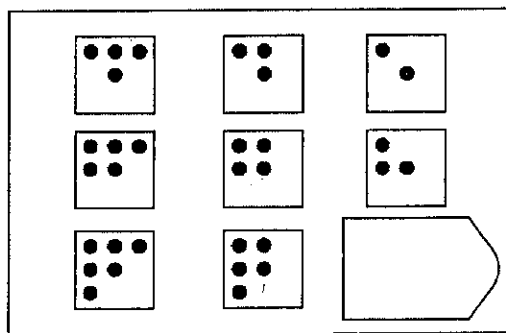


Please choose the image that best completes each of the following patterns.

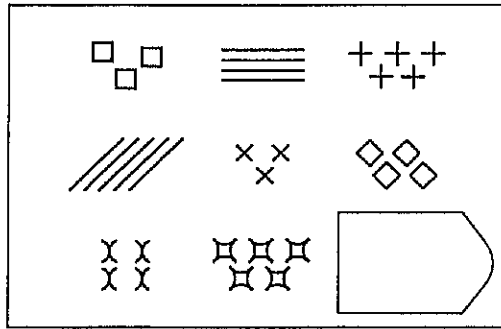
### PATTERN 1



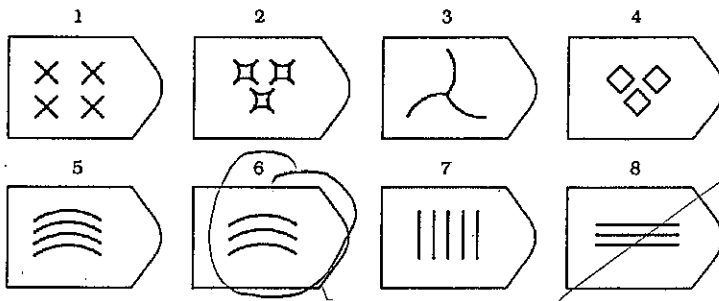
### PATTERN 2



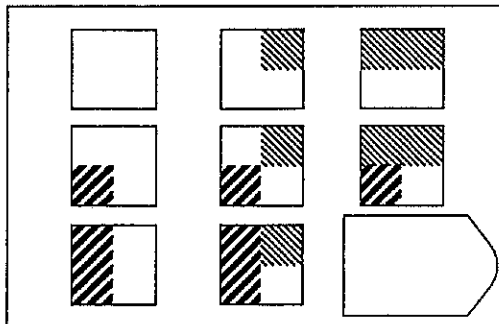
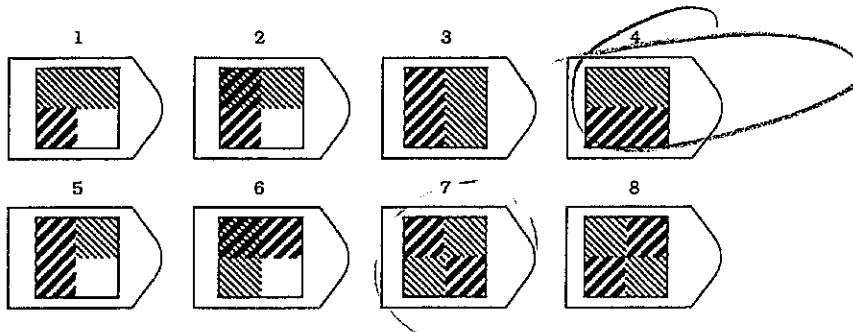
## PATTERN 3

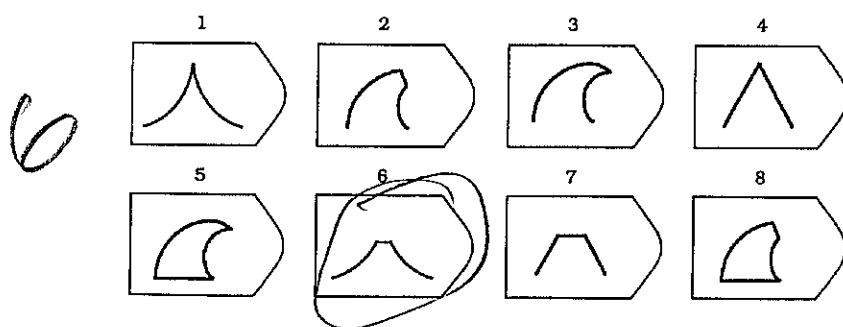
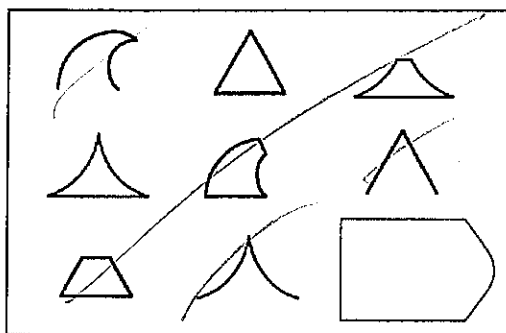


6



## PATTERN 4

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48070

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42483118

GROUP: T3

Version B

96

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- Which of the following would be considered a negative feedback to increasing global temperature?  
☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
☐ a. The magma becoming colder  
☒ b. Gas bubbles forming in the magma  
☐ c. The surrounding crust becoming hotter - *equilibrium*  
☐ d. Crystals forming in the magma
- Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
☐ a. A= erosion, B= deposition, C= uplift and erosion  
☐ b. A= erosion, B= biochemical precipitation, C= uplift and deposition  
☐ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
☒ d. A= dissolution, B= deposition, C= uplift and deposition
- Which of the following statements about the greenhouse effect on Earth is most accurate?  
☐ a. Human activities are the primary cause of the greenhouse effect.  
☒ b. Natural processes are the primary cause of the greenhouse effect.  
☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
☐ e. The human and natural causes of the greenhouse effect are not understood.
- Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
☐ a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A.  
☐ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.  
$$RT = \frac{V}{\text{Net Flux}} = \frac{ZV}{NF}$$
$$\frac{1}{1} = 1 \quad \frac{2}{2} = 1$$
- Which of the following would cause the acidity of Earth's oceans to decrease?  
☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ~~a.~~ The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ~~c.~~ The reservoir is growing smaller.
  - ~~d.~~ The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ~~c.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ~~d.~~ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



**SHORT ANSWER. 25 points each (50 points total)**

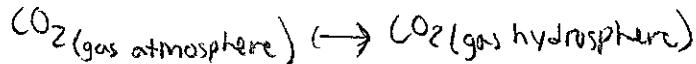
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

↳ neg = temp

increase

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



Carbon dioxide in atmosphere becomes carbon dioxide in water through dissolution. Then, through the process of carbon dioxide hydration, carbon dioxide interacts with  $\text{H}_2\text{O}$  to produce  $\text{HCO}_3^-$  (carbonate) and  $\text{H}^+$ . This hydrogen ion is what makes it acidic. Thus, as atmospheric  $\text{CO}_2$  increases,  $\text{CO}_2$  in the ocean increases causing more carbon dioxide hydration and more ocean acidification. However, with an increase in atmospheric  $\text{CO}_2$ , there will also be an increase in temperature. The ocean can hold more  $\text{CO}_2$  in cold water and less in warm water. Therefore, as temperature increases, the ocean cannot hold as much  $\text{CO}_2$ . Thus, this acts as a negative feedback loop since  $\text{CO}_2$  increases in the ocean but not as much as it would if the temp. didn't increase.

→ this temp. increase acts as a negative feedback loop

25



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

block sunlight  
increase CO<sub>2</sub> so ↑ greenhouse gases  
but less light

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

To begin, the greenhouse effect relates to the process that heats Earth's atmosphere. The sun ~~reflects~~<sup>emits</sup> mostly visible light. This energy passes through the atmosphere (and the greenhouse gases) because it has a shorter wavelength. Thus, visible light reaches Earth's surface. Some of this visible light is reflected by ice, clouds etc. Additionally, some of this visible light is absorbed by Earth's surface, ~~reflecting~~<sup>re-emitting</sup> it back as infrared energy. Infrared radiation, with a longer wavelength, is absorbed by the greenhouse gases in the atmosphere. These gases become excited and reradiate the IR, warming Earth's surface.

With increased volcanism, there is an increase in atmospheric CO<sub>2</sub>, one of the three greenhouse gases. Thus, there is an increase in the greenhouse gases' ability to absorb infrared radiation. However, volcanic eruptions also include the release of ash clouds that prevent visible light from reaching Earth's surface (and being absorbed + reremitted as IR) by reflecting ~~the~~<sup>more</sup> visible light <sup>back</sup> into space. Thus, there would be less infrared radiation to be absorbed by the greenhouse gases, regardless of the increased CO<sub>2</sub>. As a result, Earth's atmospheric temperature would decrease.

24

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Degassing, for example, is the movement of CO<sub>2</sub> (gas) from the hydrosphere to the atmosphere. Evaporation involves transforming a liquid in the hydrosphere into a gas in the atmosphere.

Earn up to 1 additional point on your course grade

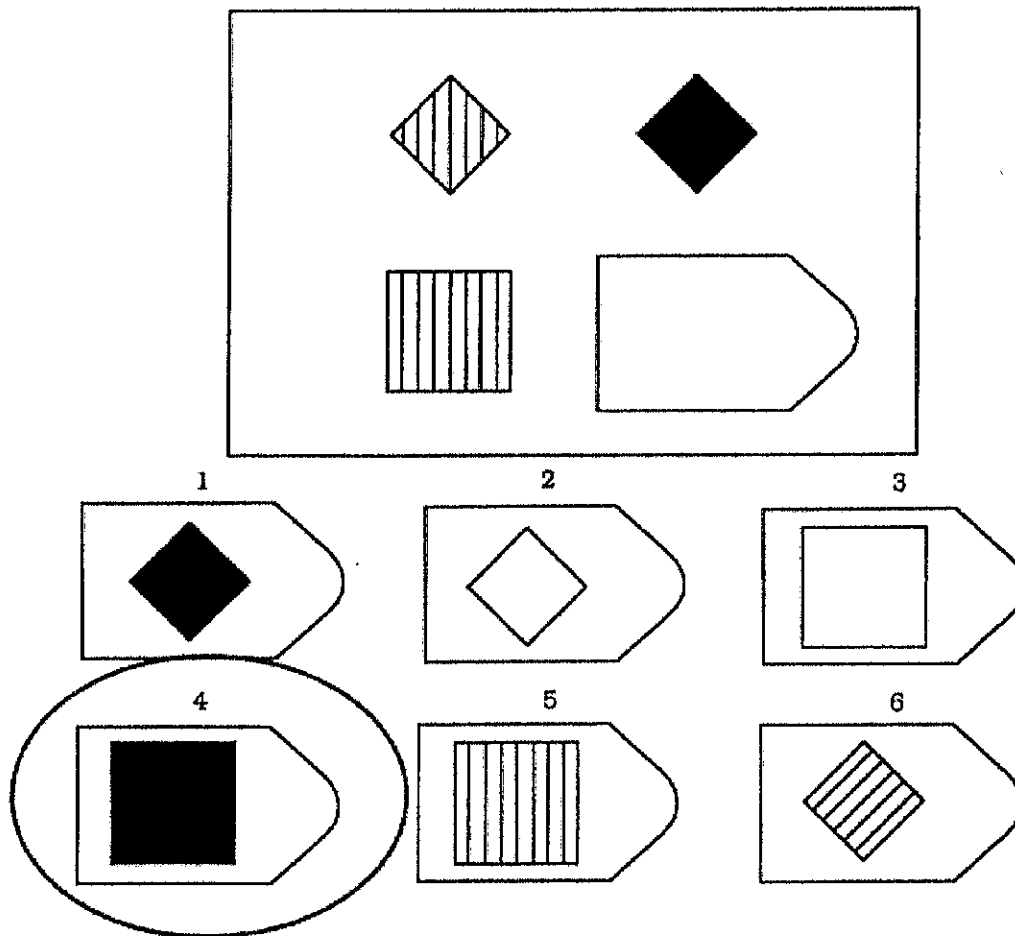
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

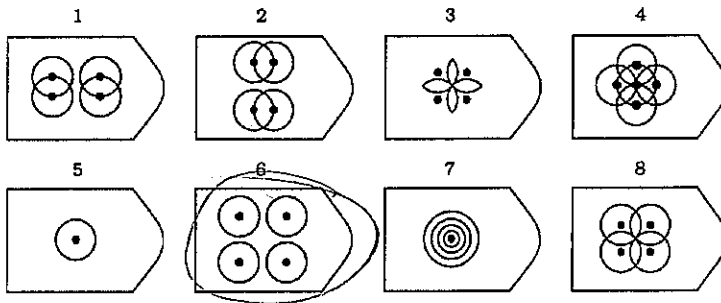
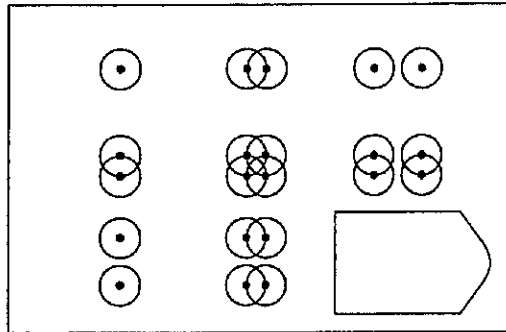


**Answer: 4**

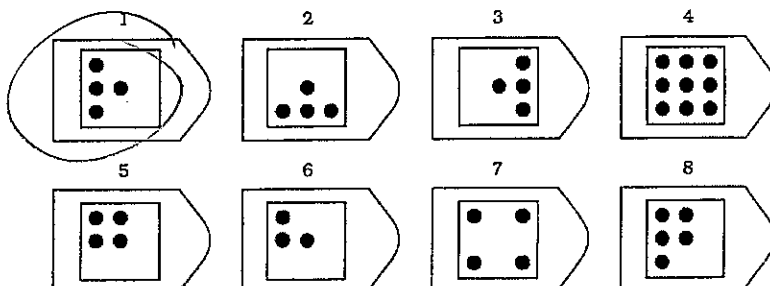
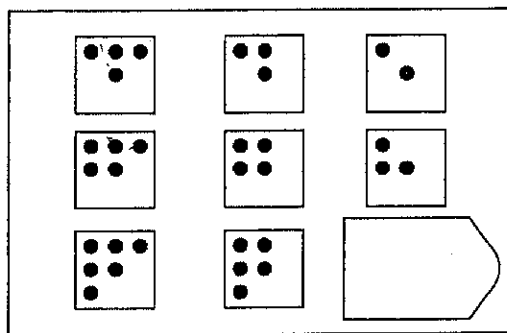
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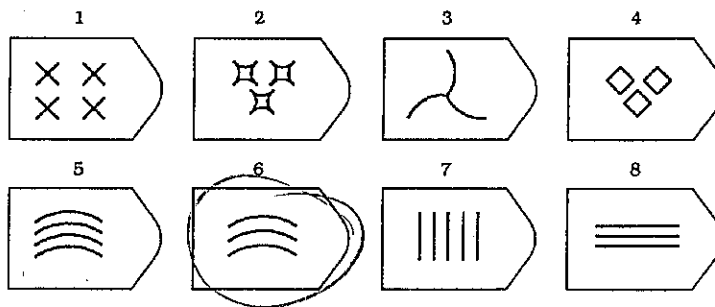
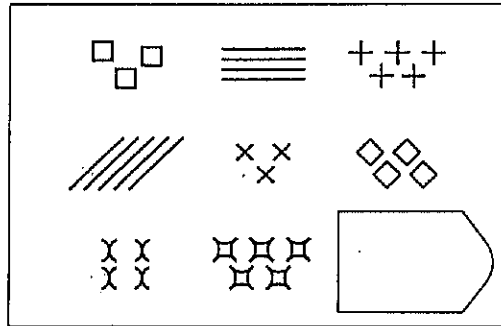
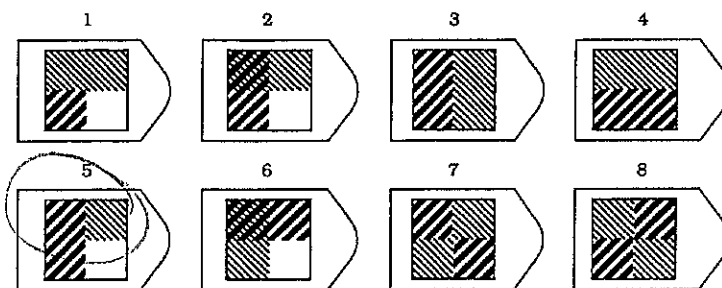
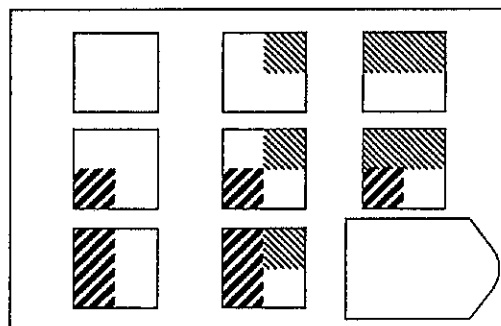
Please choose the image that best completes each of the following patterns.

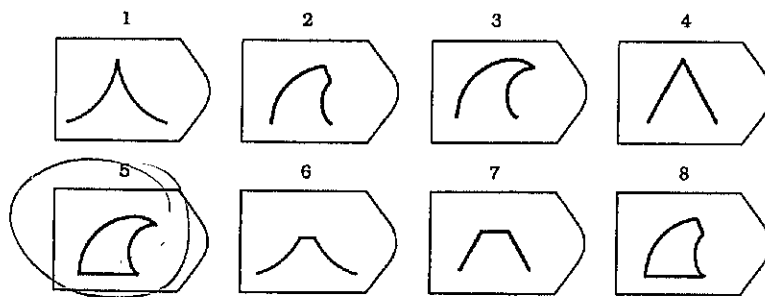
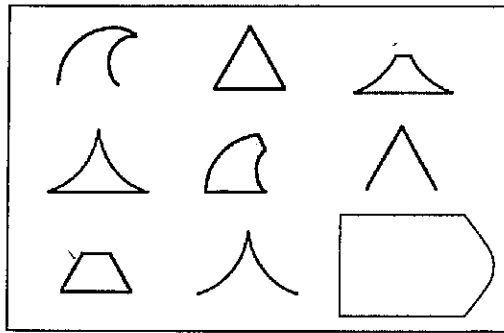
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 60154

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

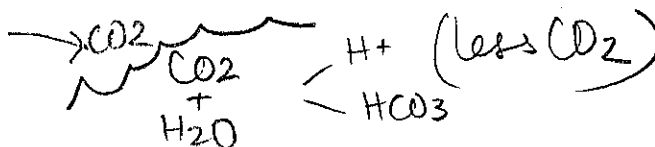
STUDENT NAME: A42609057  
Version B

GROUP: T3

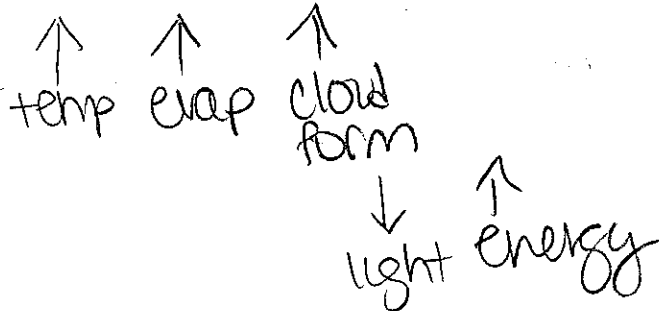
82

MULTIPLE-CHOICE. 5 points each (50 points total).

- C** 1. Which of the following would be considered a negative feedback to increasing global temperature?
- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- C** 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☐ a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - ☐ c. The surrounding crust becoming hotter
  - ☐ d. Crystals forming in the magma
- A** 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - ☐ b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☐ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ☐ d. A= dissolution, B= deposition, C= uplift and deposition
- B** 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☐ a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect. *clearly it is the primary cause since it has been occurring since before humans*
  - ☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☐ e. The human and natural causes of the greenhouse effect are not understood.
- B** 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☐ a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A. *=  $\frac{A}{\text{flux}}$  = amount around*
  - ☐ c. Reservoir A and Reservoir B have equal residence times.
  - ☐ d. More information about Reservoir A and Reservoir B is needed. *=  $\frac{B}{\text{flux}}$  =  $\frac{50}{5} = 10$ ,  $\frac{25}{5} = 5$*
- A** 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.



- B** 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- B** ☐ a. The reservoir will eventually disappear.  $1000$   
☒ **b.** The reservoir is not in equilibrium.  $+50$  overall (net)  
☐ c. The reservoir is growing smaller.  
☐ d. The reservoir's residence time is 10 years.  $\frac{1000}{50} = 20$
- B** 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- B** ☐ a. The Earth's atmosphere would become colder than it is today. b/c it is over the natural amount  
☒ **b.** The Earth's atmosphere would become warmer than it is today.  
☐ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A** 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A** ☒ **a.** Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- D** 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- B** ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☐ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
☒ **d.** More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



SHORT ANSWER. 25 points each (50 points total)

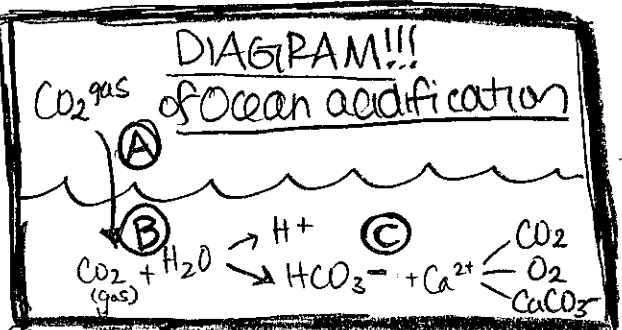
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is a process that requires the dissolution of  $\text{CO}_2$  as a gas into the oceans (still as a gas). If  $\text{CO}_2$  was increased in the atmosphere, there would be increased  $\text{CO}_2$  in the oceans as well. When the  $\text{CO}_2$  dissolves into the ocean, as seen in (A) of the diagram, it undergoes the process of "carbon dioxide hydration" (B). In doing so, it combines  $\text{CO}_2$  and  $\text{H}_2\text{O}$  to yield hydrogen ions and hydrogen carbonate.

Later, the carbonate ( $\text{HCO}_3^-$ ) combines with Calcium ions to yield  $\text{CO}_2$ , Oxygen, and calcium carbonate (shells). Because increased amounts of  $\text{CO}_2$  will yield higher frequency of carbon dioxide hydration, there will be an increase in the amount of

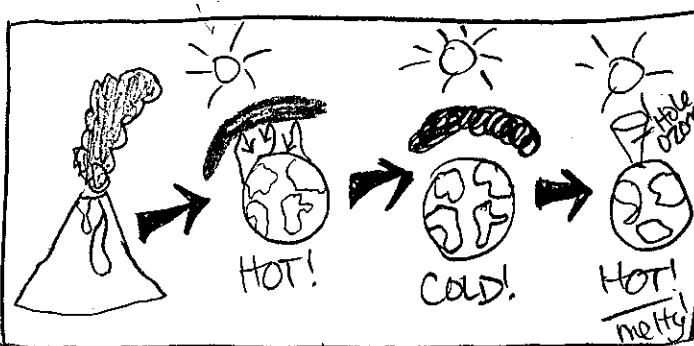


hydrogen ions ( $\text{H}^+$ ) in the oceans. In other words, the water's pH will be more acidic and obviously less basic. This can lead to the leaching of coral reefs, which can devastate the organisms that rely on them for survival. In addition, with more biochemical precipitation occurring (C), there is increased  $\text{CO}_2$  released to either remain in the hydrosphere or degas back into the atmosphere. Feedback loops are present within this process of both the negative and positive origin. Since bonds forming give off energy, the negative feedback loop of water temperature works against the processes of increased heat,  $\text{CO}_2$  and acidification. This means that as  $\text{CO}_2$  is increased in the atmosphere, it will trap infrared light and warm up the atmosphere. Trying to move to equilibrium, the water will also warm up. But, with regard to water temperatures, the colder it is, the less gas it can hold. So, the increased  $\text{CO}_2$  will yield more  $\text{CO}_2$  and  $\text{H}^+$  through the processes of dissolution, hydration, & biochem precipitation, but in doing so, heat the water and make it less capable of dissolving  $\text{CO}_2$  to continue these processes. The positive feedback loop works to further ocean acidification. An increase in  $\text{CO}_2$  in the atmosphere yields  $\text{H}^+$  and more  $\text{CO}_2$  through biochemical precipitation, which can lead to more acidification and will release more  $\text{H}^+$  and  $\text{CO}_2$  for these processes.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.



If volcanism increased on Earth, and large ash clouds were expelled into the atmosphere, the smoke would first act like a greenhouse gas. This means that as sunlight (visible, UV & some IR) with its short wavelengths was absorbed by the Earth and converted into heat (IR), it would be

absorbed in the atmosphere by the gases, which get excited and heat up. Usually these are  $\text{CO}_2$ , methane, and water vapor. Then, the heat gets trapped with its longer wavelength and gets redirected into the lower atmosphere. If it were by volcanic ash & smoke, however, it would only temporarily heat the Earth up until no visible/UV light could penetrate through the smoke and ash. Then, without light or subsequent heat, the Earth's temperature would drastically decrease. Later, when the ash & smoke clear, more atmospheric temperature changes could occur. Since volcanic ash is good for fertilizing, once the sunlight could make it through, any farming or vegetation that survived would flourish and therefore use  $\text{CO}_2$ , decreasing the amount of  $\text{CO}_2$  in the atmosphere. In addition, because volcanoes give off sulfate, which can be used to reduce the effects of global warming, the climate would probably be significantly more moderate for a while, although it would potentially eat away at the ozone layer & increase melting of polar ice & glaciers. If volcanism increased, the temperature of the atmosphere, liquid, and biosphere would change in many ways.

Extra credit (2 points)

How are evaporation and degassing similar and/or different?

Similar: Both deal with moving from the hydrosphere to atmosphere.  
Different: Degassing entails that it will be in its gas state when it is in a liquid & in air. Evaporation entails going from liquid state in a liquid to

Earn up to 1 additional point on your course grade

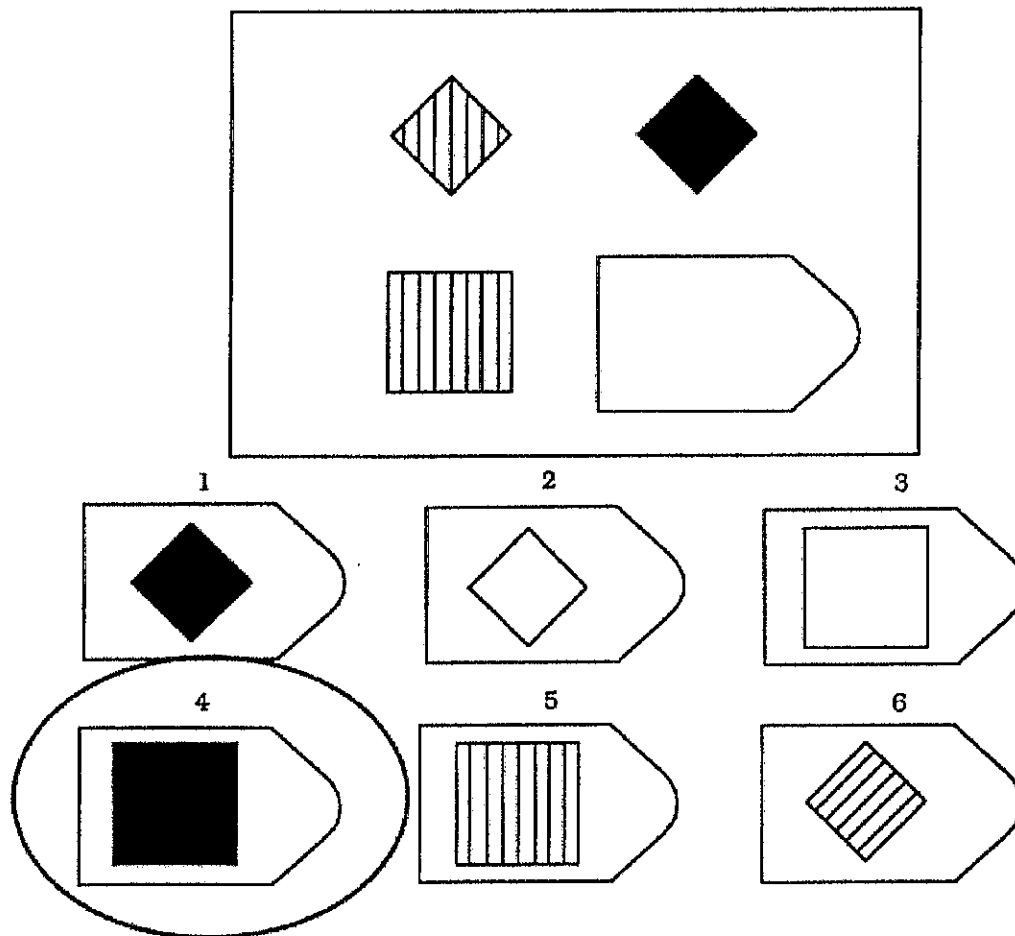
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



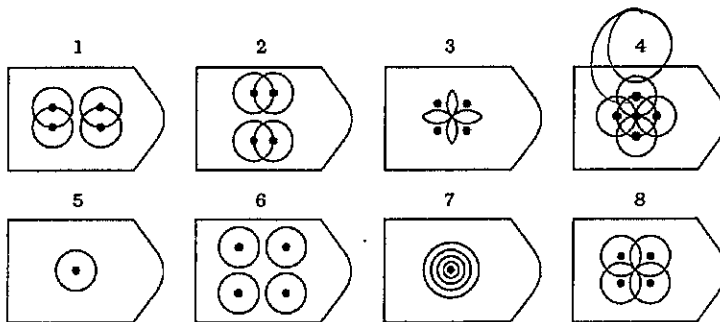
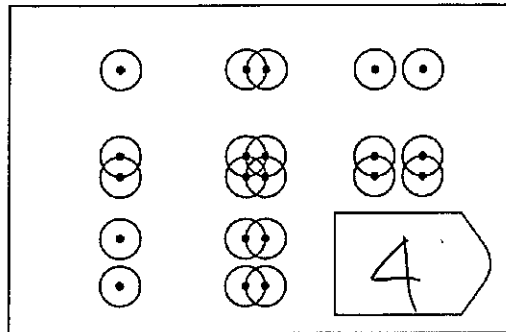
**Answer: 4**

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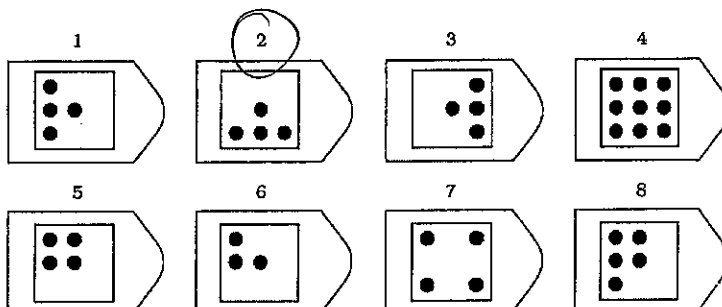
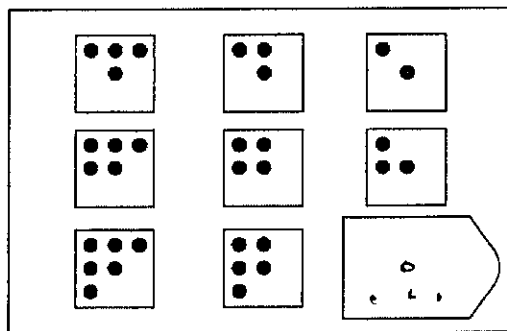
A42607057

Please choose the image that best completes each of the following patterns.

## PATTERN 1

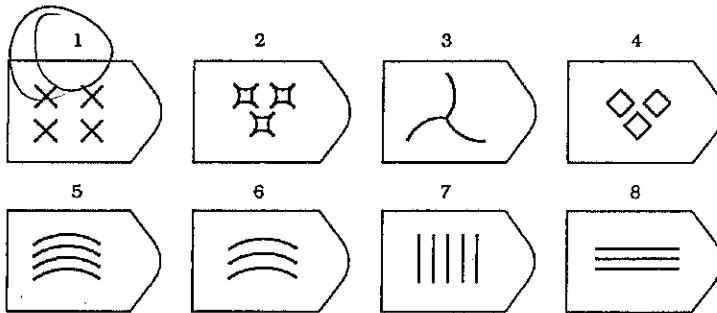
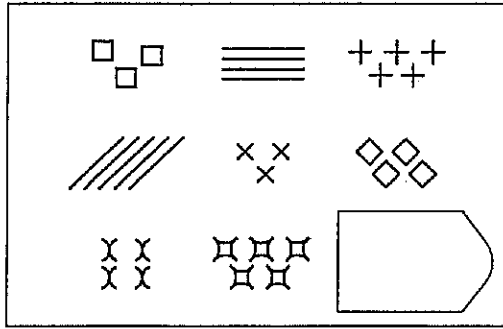


## PATTERN 2



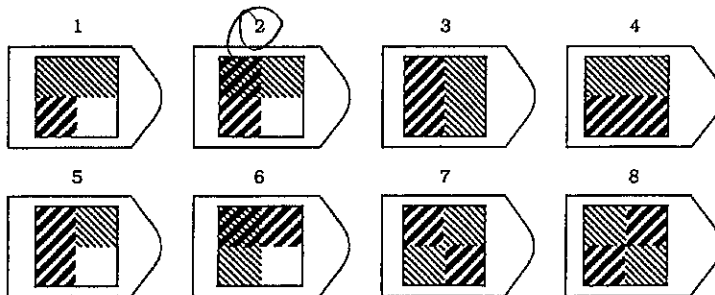
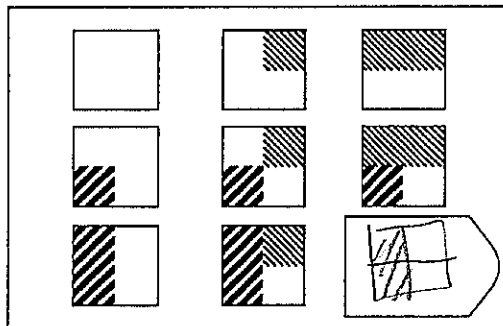
**PATTERN 3**

1



**PATTERN 4**

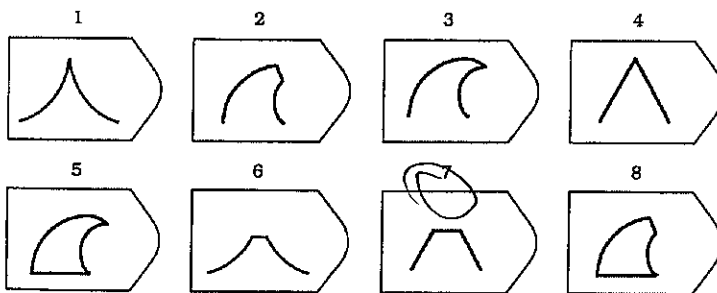
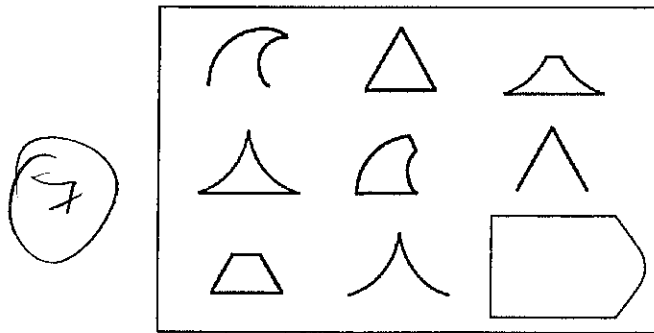
2





A4260957

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

B 1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

A 2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

D 3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

C 4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

- B 5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.
- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

C 1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

C 2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 49770

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 3759 9308

GROUP: T4

Version A

60

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- D1.** Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - (d.)** Crystals forming in the magma
- D2.** Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - (d.)** An increase in desert formation resulting in more dusting blowing into the atmosphere
- C3.** Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - (c.)** A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- C4.** Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - (c.)** Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- B5.** Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - (b.)** A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- B6.** Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - (b.)** Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

- B** 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - b.** The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- A** 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a.** Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- C** 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c.** Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- D** 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d.** The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

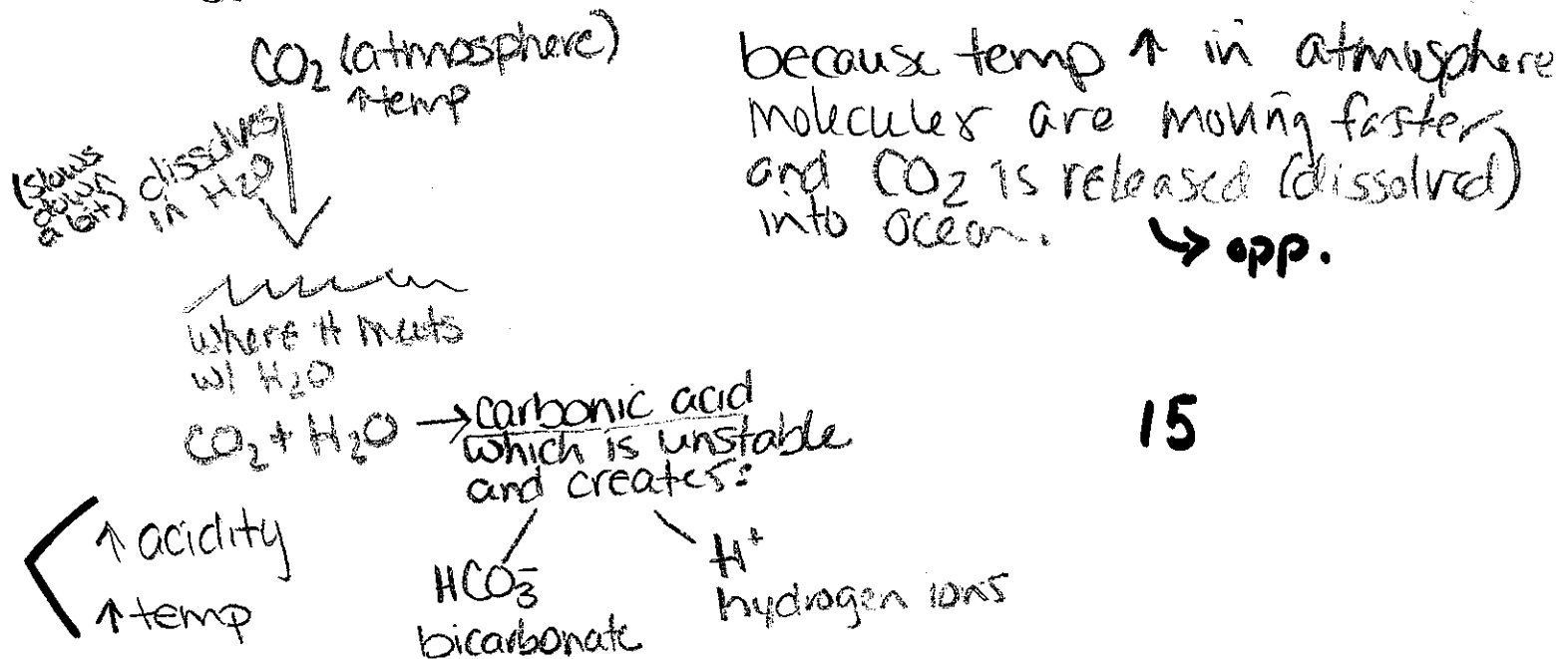
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in  $\text{CO}_2$  in the atmosphere can affect ocean acidification in multiple ways  
Ocean Acidification can be explained in my diagram below



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An example of a positive feedback loop as a result of ocean acidification would be an increase in temperature when more water is then evaporated into atmosphere, creating an increase in water vapor (gh gas) in the atmosphere

An example of a negative feedback loop would be a decrease in temperature of the atmosphere as more water evaporates into the atmosphere and increase cloud formation blocking radiation from the sun and as a result decreasing  $\Delta$  temperature

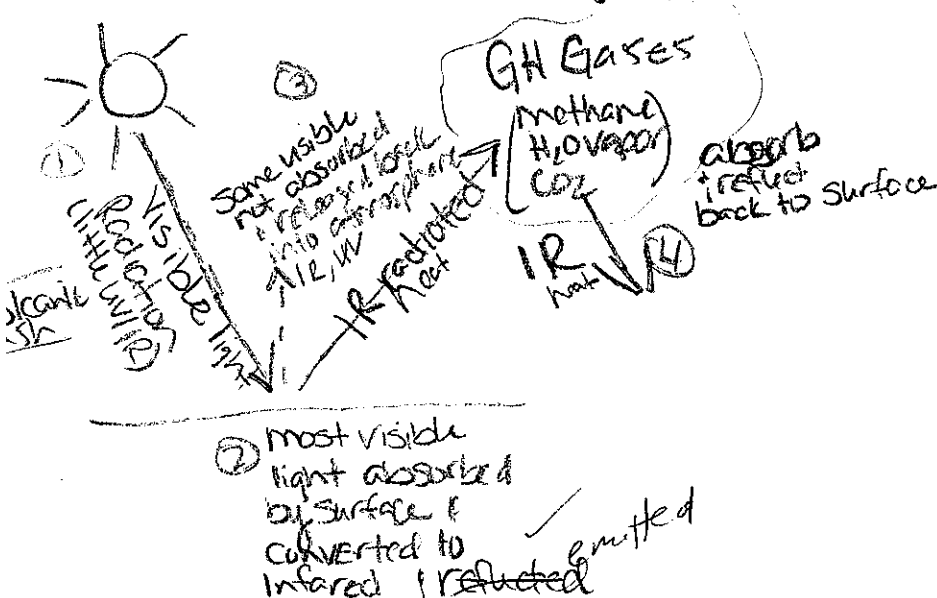
2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

20

As volcanoes erupt they release  $\text{CO}_2$  into the atmosphere which is a greenhouse gas. Greenhouse gases reflect infrared radiation back to earth's surface as fully explained in this diagram:



With an  $\uparrow$  in  $\text{CO}_2$  in the atmosphere as a result of volcanic eruption (more GH gases will be in atmosphere) reflecting IR radiation back to Earth.

Although  $\text{CO}_2$  increase as a result of volcanic eruption will increase Earth's temperature, we also must think of the increase in volcanic ash clouds. When volcanoes erupt and form large ash clouds these will block some of the visible light radiation from the sun from never meeting the Earth's surface. This will result in less visible light being absorbed by Earth's surface and a decrease in reflected IR radiation (neg. feedback) must

Extra credit (2 points).

2 How are evaporation and degassing similar and/or different?

They are different because evaporation changes from liquid to gas where degassing remains a gas.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

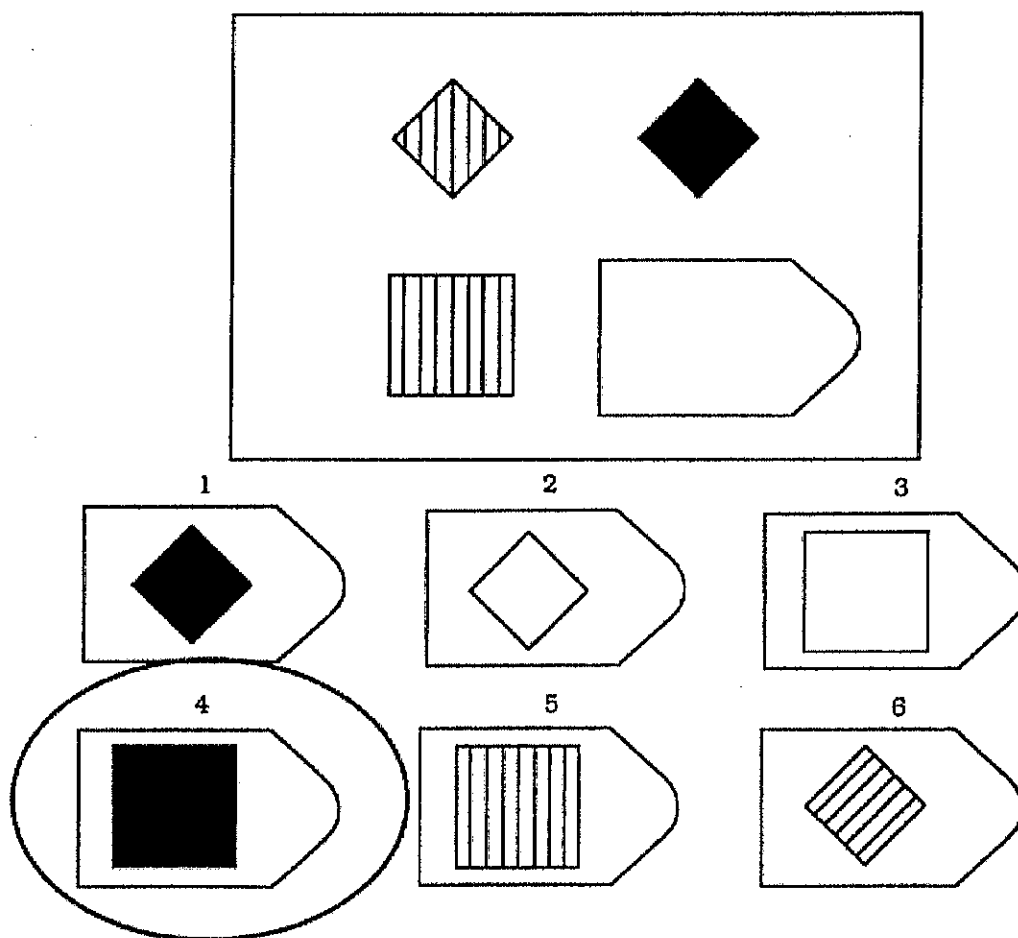
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

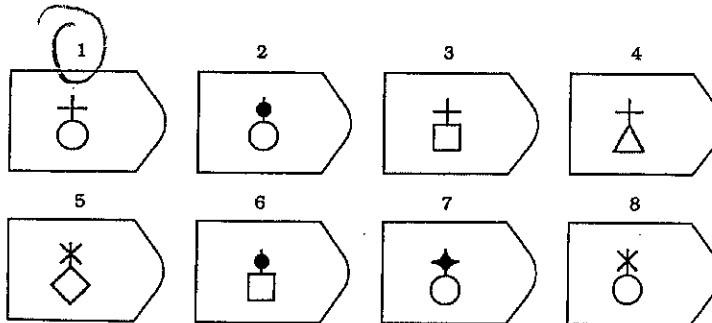
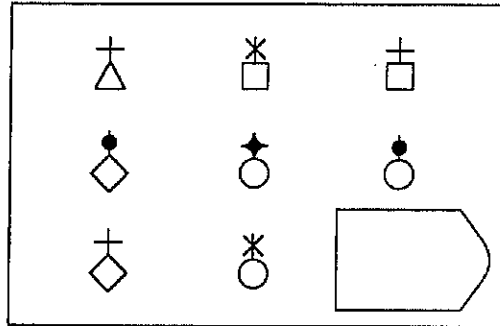


**Answer: 4**

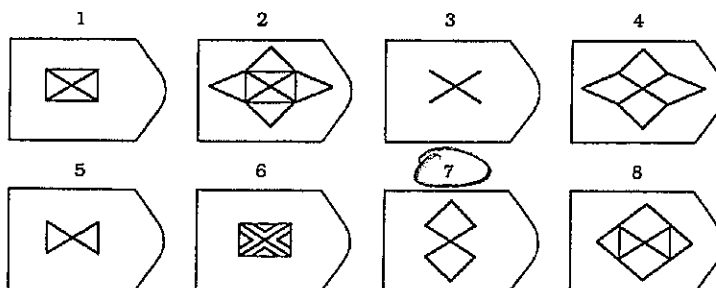
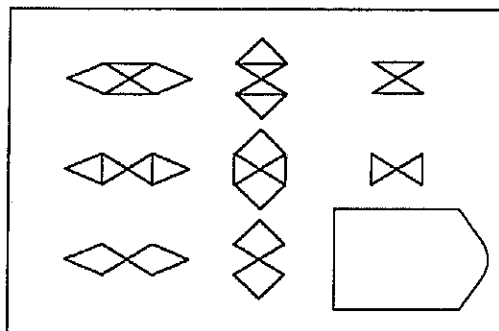
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Please choose the image that best completes each of the following patterns.

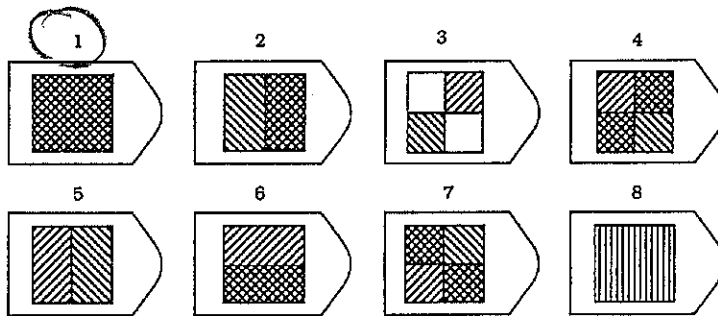
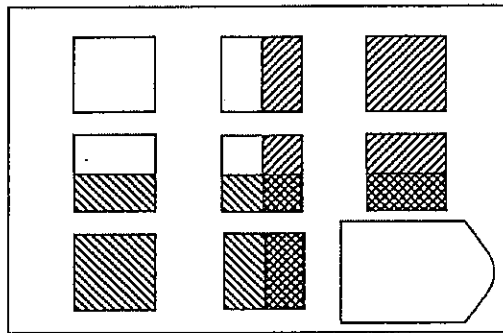
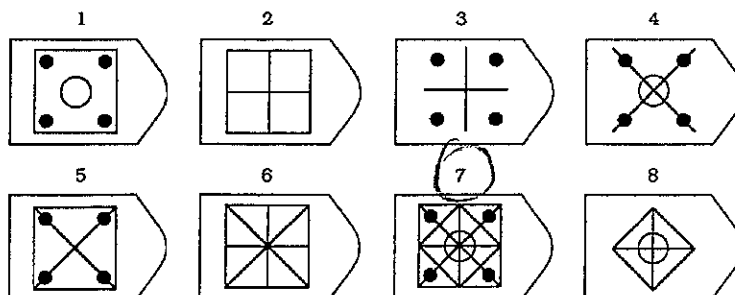
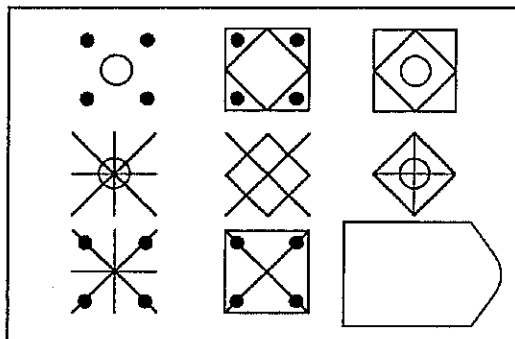
### PATTERN 1



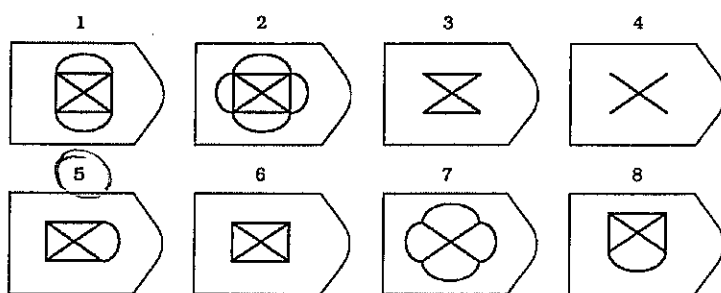
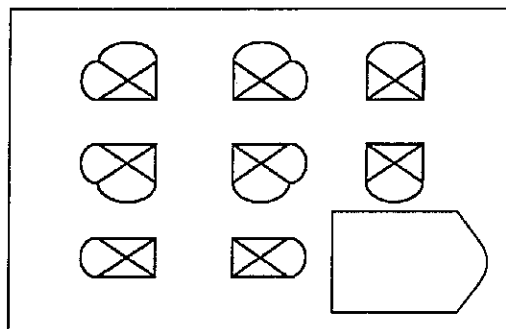
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- ☒ A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- ☒ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - ☒ C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 23 years

What is your home zip code? 45917

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A40177778  
Version A

GROUP: T4

77

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- ☐ a. The magma becoming colder  
☐ b. Gas bubbles forming in the magma *less dense*  
☒ c. The surrounding crust becoming hotter  
☐ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed *increase*  
☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere *increase*  
☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat *decrease in*  
☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- ☐ a. A = erosion, B = deposition, C = uplift and erosion  
☐ b. A = erosion, B = biochemical precipitation, C = uplift and deposition  
☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion  
☐ d. A = dissolution, B = deposition, C = uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- ☐ a. Human activities are the primary cause of the greenhouse effect.  
☐ b. Natural processes are the primary cause of the greenhouse effect.  
☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
☐ e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- ☐ a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A.  
☐ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ~~b. Reflection of more solar radiation, causing atmospheric temperature to increase~~
  - ~~c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase~~
  - ~~d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease~~

B

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- energy released bonds form
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

~~10.~~ What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- C
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Positive?

When there is more carbon dioxide in the air, atmospheric temperatures also increase.

When atmospheric temp goes up, so does ocean temp. Warm water cannot hold as much  $\text{CO}_2$  as cold water. When  $\text{CO}_2$  gas dissolves into the ocean and reacts with water, carbonic acid is formed. Carbonic acid  $\frac{1}{2}$  water together form bicarbonate ions  $\frac{1}{2}$  hydrogen ions. The more hydrogen ions present in the water, the more acidic the ocean is. If the amount of  $\text{CO}_2$  in the ocean decreases because of an increase in atmospheric  $\frac{1}{2}$  ocean temps this is a negative feedback loop. This also means there is not as much  $\text{CO}_2$  to produce carbonic acid  $\frac{1}{2}$  hydrogen ions causing the ocean to be less acidic. The relationship between increased ocean temp and a decrease in acidification is a negative loop.

+  $\text{CO}_2$   
+ ocean  $\frac{1}{2}$   
atmosphere  
temp =  
pos.  
feedback

15

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?  $\rightarrow$  Sulfur dioxide

Your answer should include:

- a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.  
b. Clear connections between events and changes in atmospheric temperature.

25

The greenhouse effect is the process of sun radiating mostly visible light energy in the form of radiation. When the visible light reaches earth's surface some is reflected directly back to space in its original form. Other energy is absorbed by the earth's surface, converted & reflected as infrared heat energy into the atmosphere. This heat energy is what actually heats the atmosphere. The greenhouse gases in the atmosphere absorb this infrared energy & re-emit it in all directions, some to the upper atmosphere, some back to the earth's surface. The "trapped" energy that is essentially being re-emitted back & forth causes atmospheric temperatures to increase. Therefore the more greenhouse gases in the atmosphere, the more heat energy can be absorbed/re-emitted. However, the ash clouds remain in the upper atmosphere after a volcanic eruption. This blocks the visible light from reaching earth & converting to heat energy. Without this conversion, earth temp will decrease.

Extra credit (2 points). How are evaporation and degassing similar and/or different?

Evaporation: process of water liquid  $\rightarrow$  water gas  
degassing: process of  $\text{CO}_2$  gas in water  $\rightarrow$   $\text{CO}_2$  gas in atmosphere.

Earn up to 1 additional point on your course grade

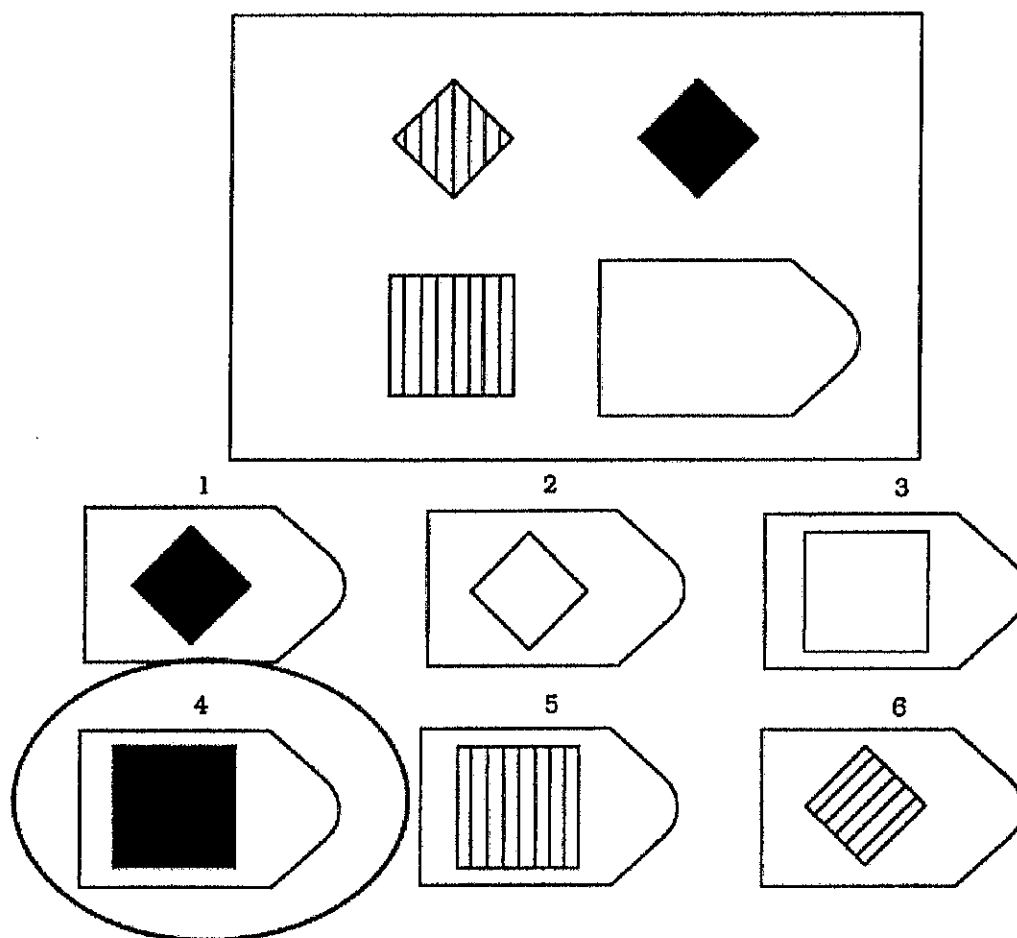
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

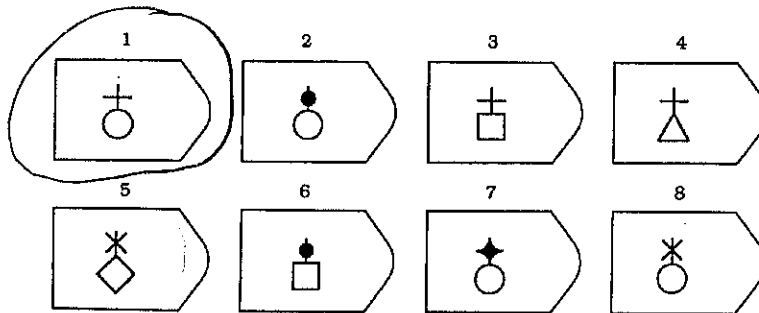
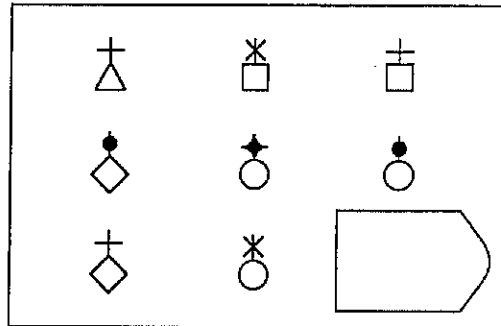


**Answer: 4**

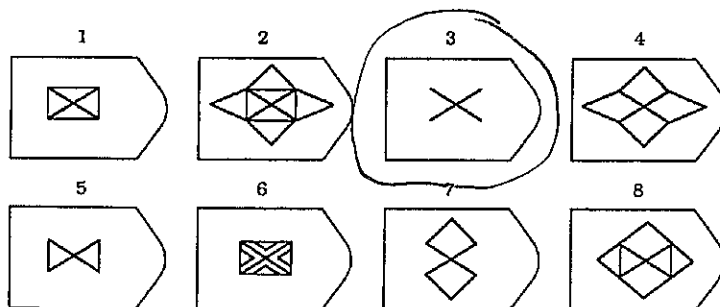
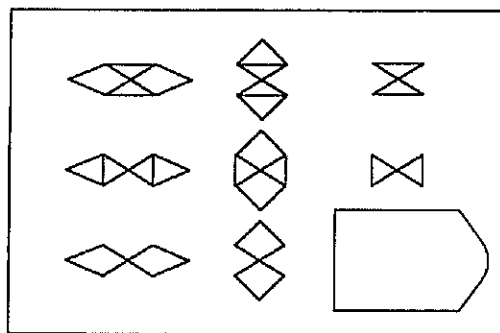
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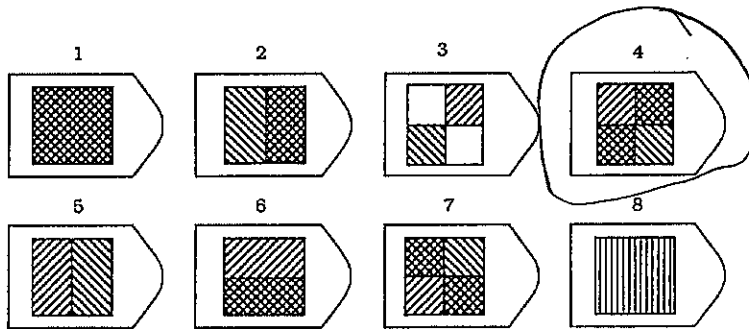
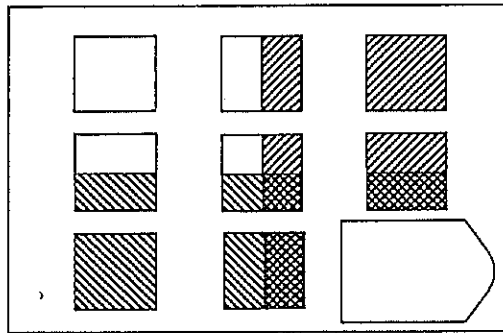
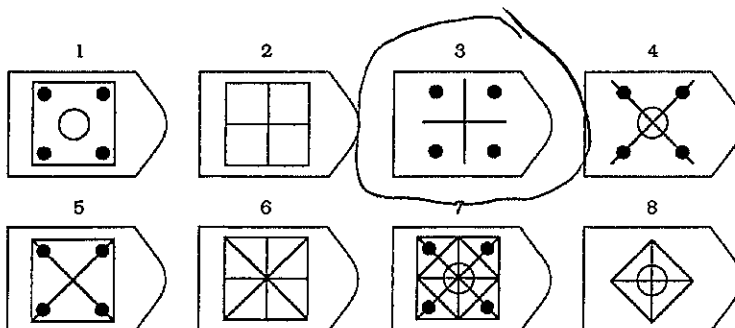
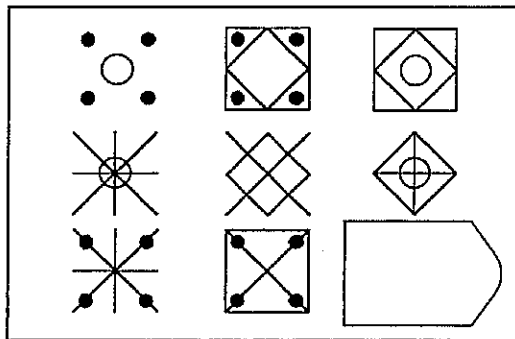
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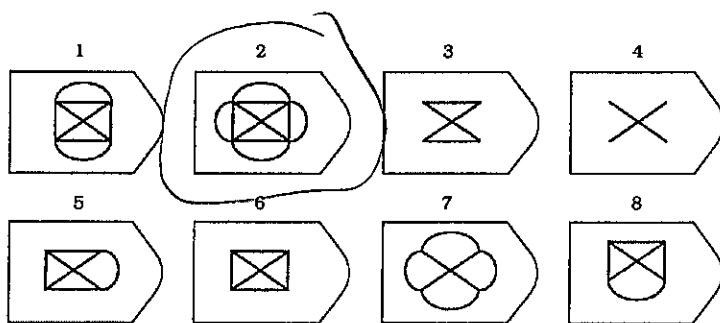
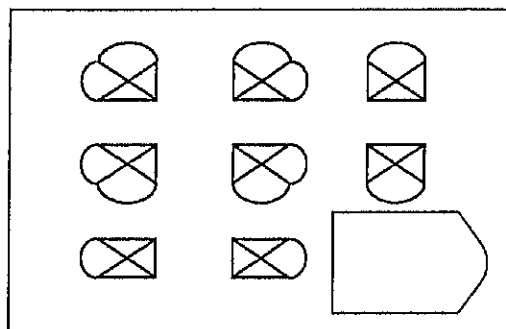
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

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- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
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- ☒ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

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- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
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- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE



5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - ☒ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

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- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- ☒ B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 40443

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 40627897  
Version A

GROUP: T4

65

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- a. The magma becoming colder
- b. Gas bubbles forming in the magma
- c. The surrounding crust becoming hotter
- ☒ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
- ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
- c. An increase in evaporation and cloud formation resulting in the release of latent heat
- d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- a. A= erosion, B= deposition, C= uplift and erosion
- b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- ☒ a. Human activities are the primary cause of the greenhouse effect.
- b. Natural processes are the primary cause of the greenhouse effect.
- c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
- d. Neither human activities nor natural processes are important causes of the greenhouse effect.
- e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease? *more CO<sub>2</sub> = more acidity, less CO<sub>2</sub> = less acidity*

- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
- ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
- c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- a. Reservoir A has a shorter residence time than Reservoir B.
- ☒ b. Reservoir B has a shorter residence time than Reservoir A.
- c. Reservoir A and Reservoir B have equal residence times.
- d. More information about Reservoir A and Reservoir B is needed.

$$B \ 1000 / 10 = 100$$

$$A \ 2000 / 10 = 200$$

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

$\text{in} < \text{out} \rightarrow \text{decreasing}$   
 $\text{in} > \text{out} \rightarrow \text{increasing}$   
 $100 > 50 \rightarrow \text{increasing}$

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☒ a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidity is determined by the amount of  $\text{CO}_2$  in the seawater. The more carbon dioxide in the sea water, the greater the acidity. The  $\text{CO}_2$  in the atmosphere affects the amount of  $\text{CO}_2$  in the oceans. If there is more  $\text{CO}_2$  in the atmosphere, this will increase the amount of  $\text{CO}_2$  in the oceans. With more  $\text{CO}_2$  in the ocean, the acidity will rise.

Positive feedback occurs when an initial change creates more of that similar change. When something changes, such as an increase in amount of  $\text{CO}_2$  in the atmosphere, this will cause a similar change somewhere else, so the amount of  $\text{CO}_2$  in the hydrosphere also will increase.

Negative feedback occurs when the initial change is countered by a change in the opposite direction. For example, when the ocean acidity levels rise, the oceans react to this increase by trying to reduce the acidity. When one change elicits an opposite effect, this is negative feedback.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25

The greenhouse effect begins when the sun emits its visible solar radiation. This solar radiation goes through the earth's atmosphere and is either reflected by the earth's surface & goes back into space, or it is absorbed by the earth's surface. The visible solar radiation that is absorbed by the earth's surface is converted into infrared energy. This infrared radiation is emitted into the atmosphere & it is absorbed by greenhouse gases. The ~~greenhouse~~ gases then re-emit the energy back to the earth's atmosphere & it gets absorbed & re-radiated by the surface again. This process warms the earth's atmosphere by essentially trapping energy in the atmosphere. If there were an increase in volcanism that erupted ash into the atmosphere, less solar radiation would likely be able to reach the earth surface. With less solar radiation, the greenhouse effect would slow down, because it would not be able to absorb & radiate the infrared energy. The ash would also further trap  $\text{CO}_2$  emissions in the atmosphere. There would be a cooling on the earth's temperature because there would be less solar radiation & less greenhouse effect. It could also warm the earth if there were more  $\text{CO}_2$  & greenhouse gases trapped in the atmosphere.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both are the process of a liquid changing to a gas.

Evaporation is more w/ water & degassing has to do w/ atmosphere

Earn up to 1 additional point on your course grade

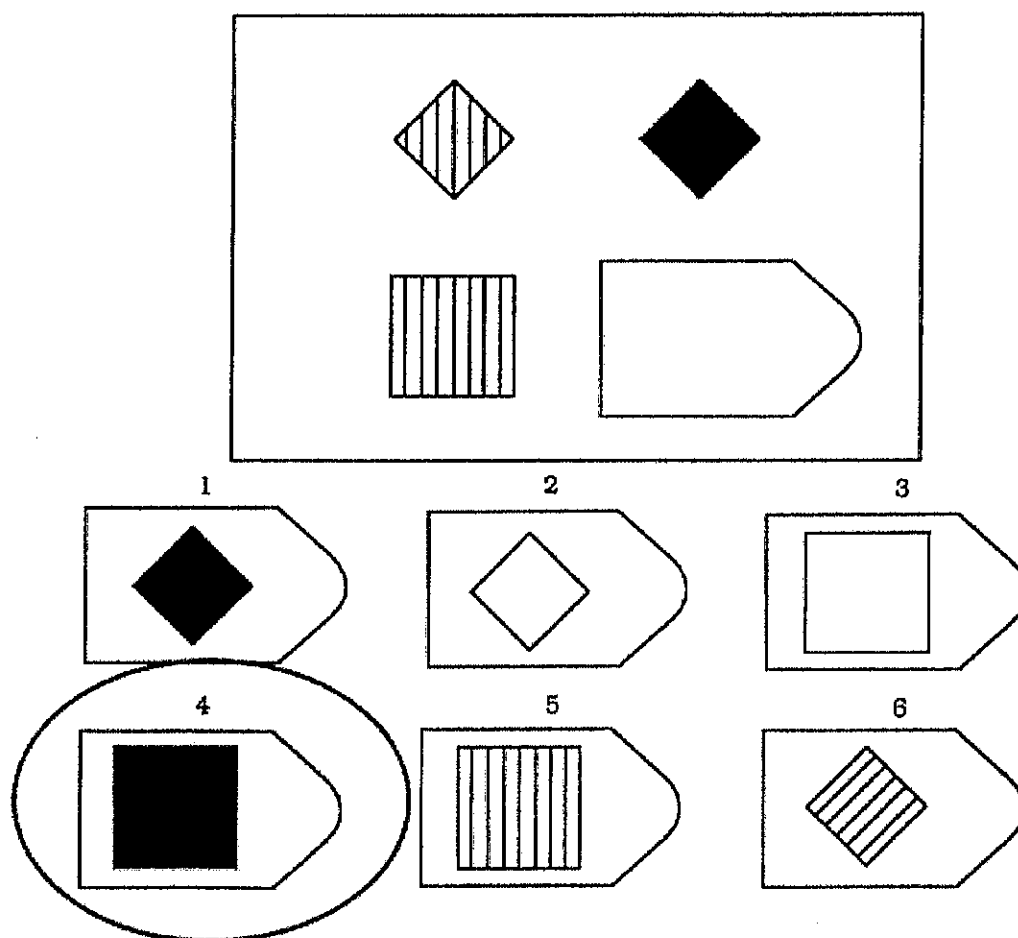
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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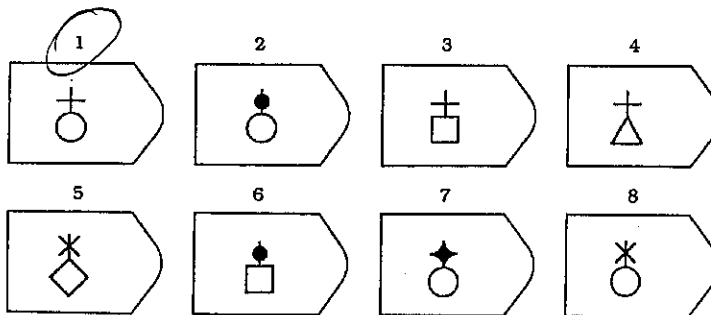
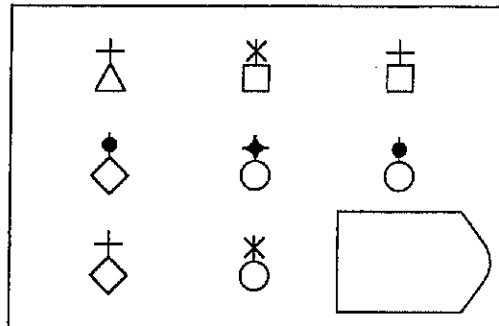


**Answer: 4**

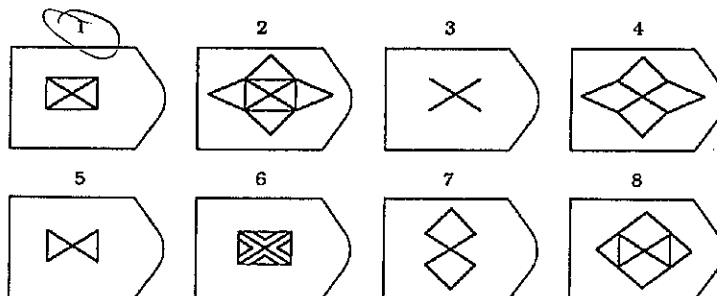
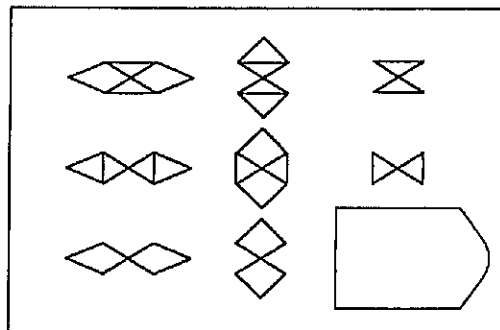
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Please choose the image that best completes each of the following patterns.

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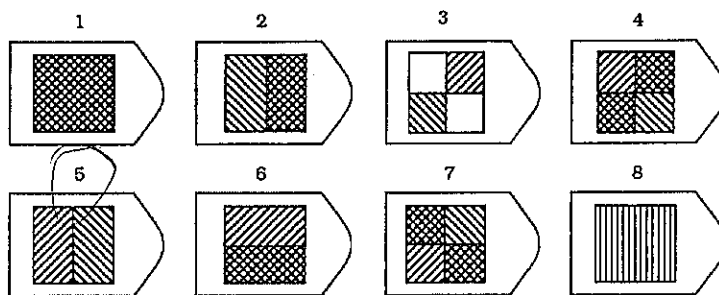
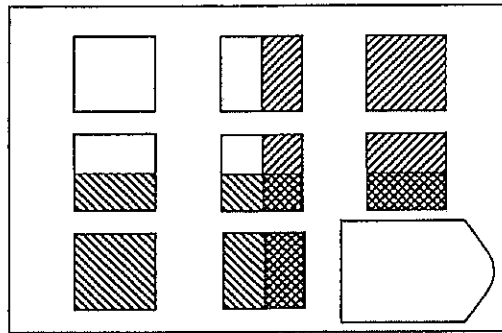
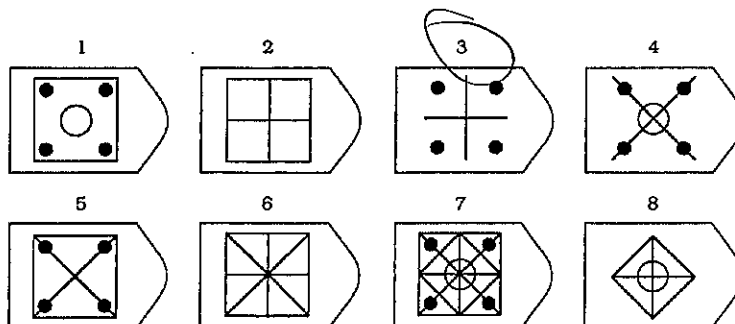
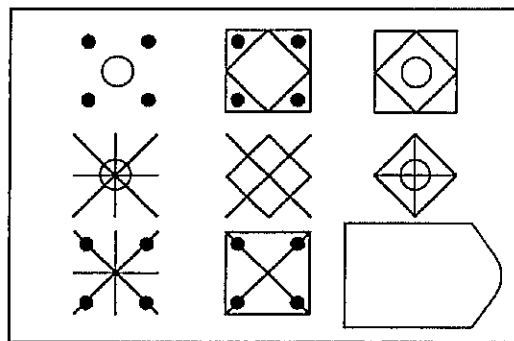


### PATTERN 2

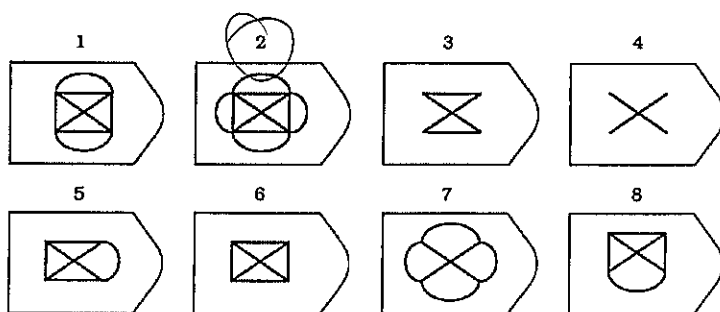
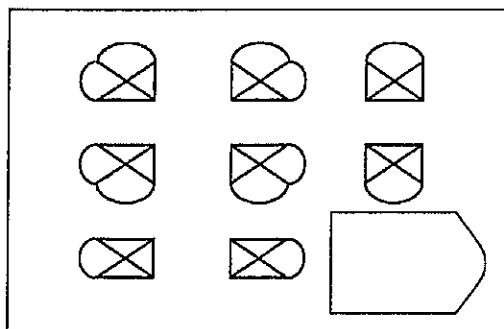


PLEASE CONTINUE ON NEXT PAGE



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

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In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

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- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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  - A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
  - B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
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PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
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- 

Please choose the response that is closest to an analogy that you might make.

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2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
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## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48313

What is your gender?

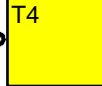
☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A43570651  
Version A

GROUP



86

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma — decrease
2. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
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  - ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
  - ☒ d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- ☒ 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

25

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the process where, as  $\text{CO}_2$  is added to the ocean, an increase of hydrogen ions ( $\text{H}^+$ ) occur and a decrease in the ocean's pH occurs. More atmospheric  $\text{CO}_2$  added to the Earth's atmosphere results in an increase of the amount of  $\text{CO}_2$  entering the ocean. Also, an increase in  $\text{CO}_2$  in the atmosphere would also reflect in having an increase of atmospheric temperatures. As the temperature of the atmosphere increases, so does the temperature of the ocean. With the water heating, it's harder for ocean to absorb gases b/c cooler temps absorb more. Ocean acidification would increase.

$\uparrow$  in atmospheric  $\text{CO}_2 \rightarrow \downarrow$  in pH levels  $\rightarrow \uparrow$  ocean acidification  
Negative feedback

$\uparrow$  in atmospheric  $\text{CO}_2 \rightarrow \uparrow$  in oceanic  $\text{CO}_2 \rightarrow \uparrow \text{H}^+$  ion  $\rightarrow \uparrow$  atmospheric temperature  
Positive feedback loop  
 $\downarrow$   
 $\uparrow$  oceanic temperature

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The Earth is heated by solar radiation of the sun. This visible light emitted by the sun goes through the atmosphere and goes to the Earth's surface, it is then reflected as infrared energy and emitted back to the atmosphere. Here greenhouse gases absorb the infrared and move a lot. They then emit these rays back to Earth's surface (how the Earth is warmed). Some of the infrared rays are emitted into space as well where it doesn't do anything. If volcanism on Earth suddenly increased, then the ashes emitted from volcanoes would layer on top of the atmosphere, making it harder for visible rays to shine through & heat the Earth. This event would cause global temperatures to decrease. But, with ash blocking the atmosphere, infrared rays are trapped within the atmosphere which heats the Earth, increasing global temperatures.

24

Extra credit (2 points).

- 2 How are evaporation and degassing similar and/or different?  
Evaporation & degassing are similar in that both are being released into the atmosphere. But evaporation changes from a liquid to a gas while degassing occurs with gases.



Earn up to 1 additional point on your course grade

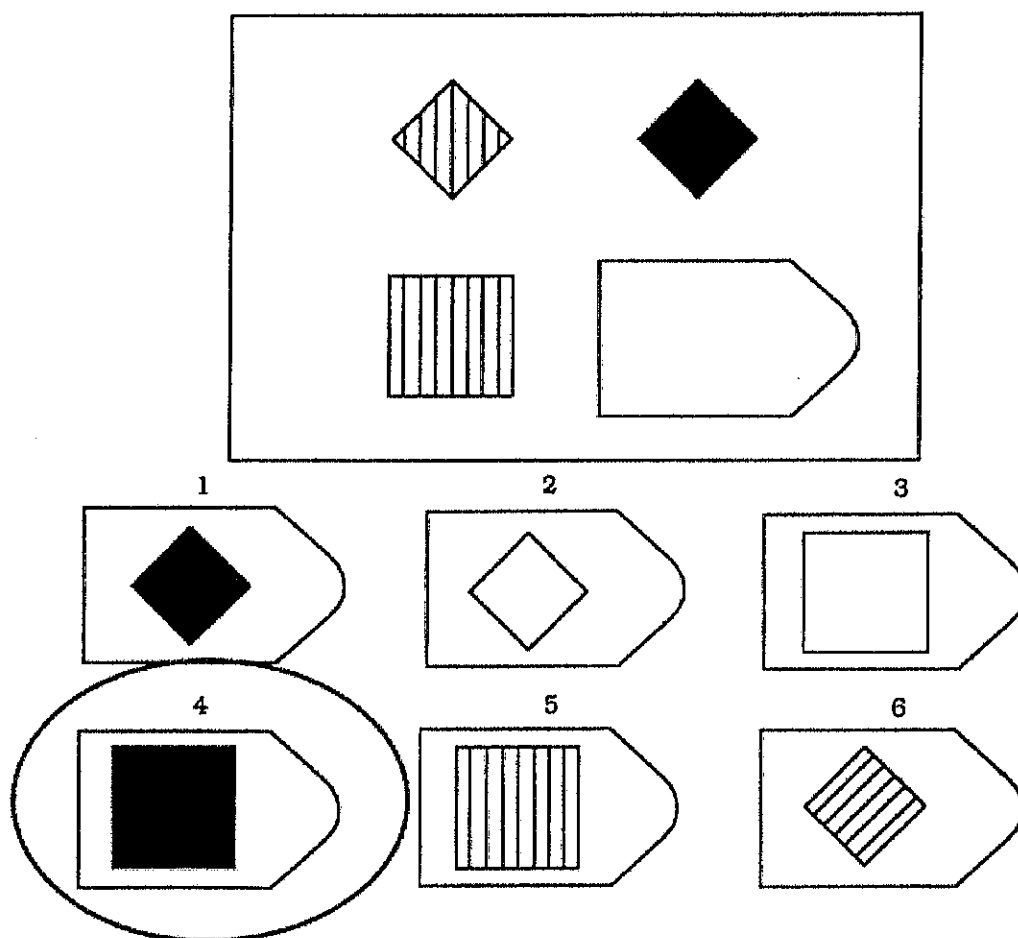
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

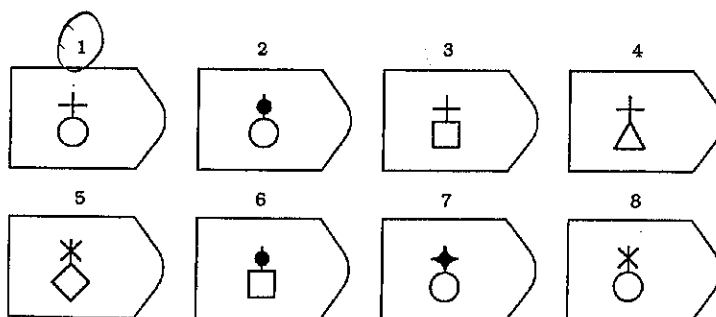
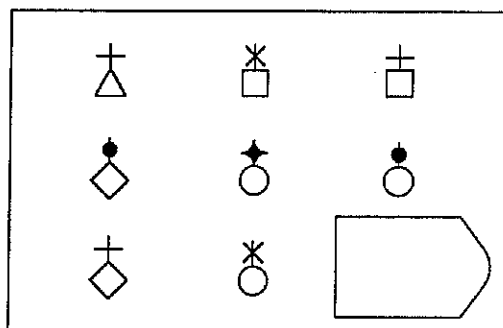


**Answer: 4**

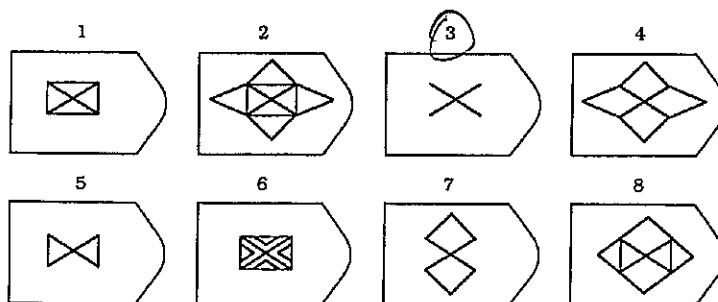
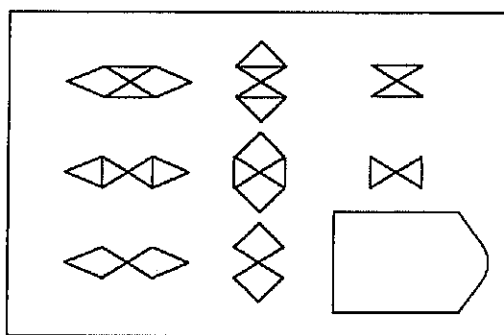
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Please choose the image that best completes each of the following patterns.

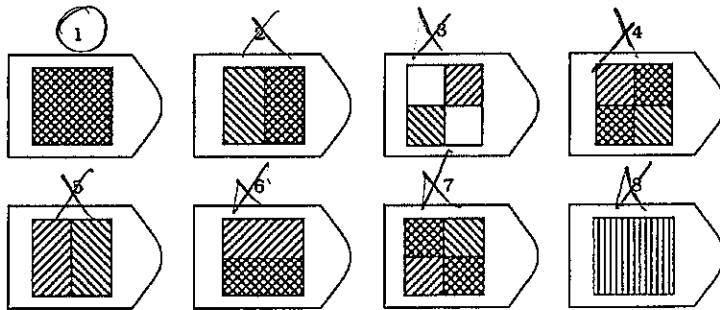
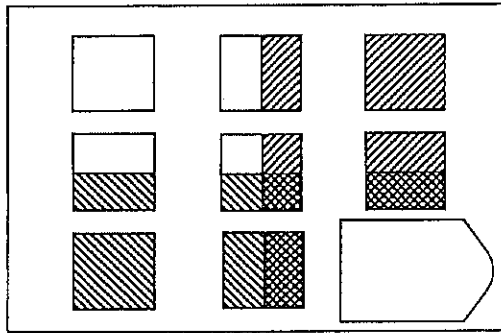
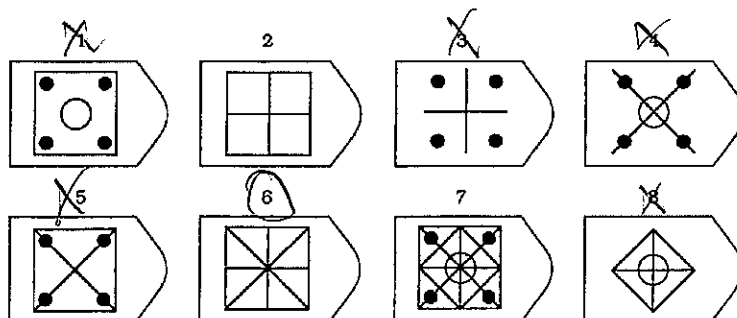
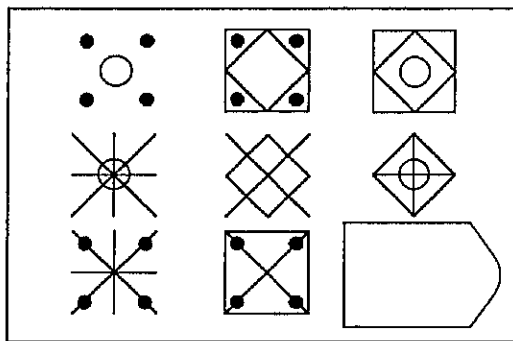
### PATTERN 1



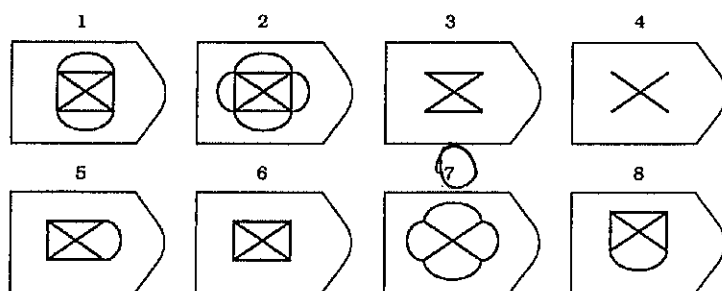
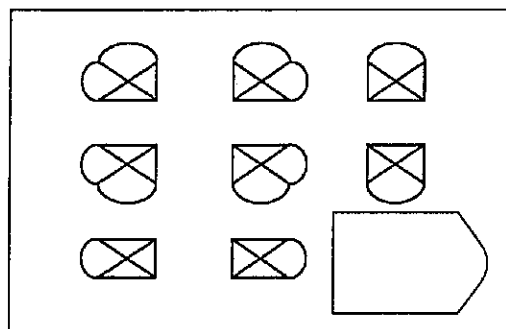
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- ☒ A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☐ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☐ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- ☒ D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- ☒ A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- ☒ B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- ☒ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☐ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- ☒ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- ☐ D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- ☒ A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- ☒ B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☐ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- ☒ D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☐ A. The plumber fixed the pump that had burst and flooded the basement.
  - ☐ B. Steven avoided midweek outings in order to have the time for a weekend trip out of town.
  - ☐ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - ☐ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - ☐ C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - ☐ D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- ☐ A. Getting the flu. They are similar because they are both caused by viruses.
  - ☒ B. Getting pink eye. They are similar because they are both contagious.
  - ☐ C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - ☐ D. Forgetting to do your homework. They are similar because they are both preventable.
  - ☐ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 79519

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

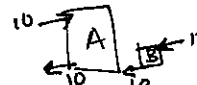
1

STUDENT NAME: A39228160  
Version B

GROUP: T5

53

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ A= erosion, B= deposition, C= uplift and erosion
  - A = erosion, B= biochemical precipitation, C= uplift and deposition
  - A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
- 
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.



**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

- D 7.** A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ~~a.~~ The reservoir will eventually disappear. ~~1000~~  $R = \frac{V}{F}$   $\frac{1000}{100} = 10$
- b. The reservoir is not in equilibrium.
- ~~c.~~ The reservoir is growing smaller.
- (d.)** The reservoir's residence time is 10 years.
- 
- C 8.** What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
- ~~b.~~ The Earth's atmosphere would become warmer than it is today.
- (c.)** The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- 
- B 9.** Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- (b.)** Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- 
- B 10.** Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- (b.)** More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

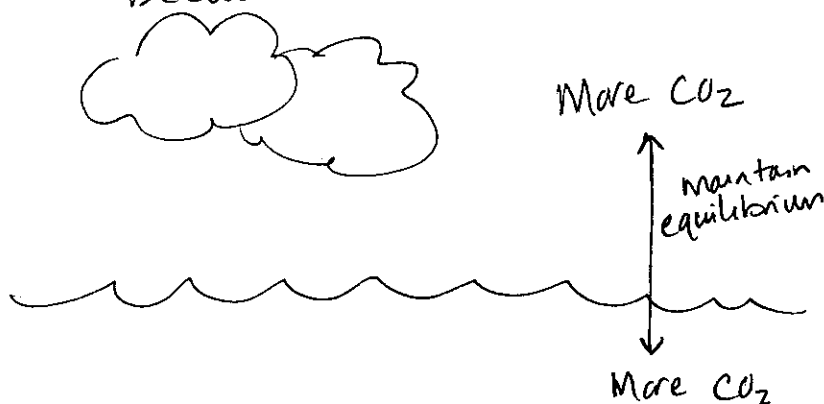
Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

If atmospheric  $\text{CO}_2$  increased, so would its residence time.

✓ Therefore, the amount of  $\text{CO}_2$  in the oceans would also increase and also have a longer residence time. The increase in  $\text{CO}_2$  + longer residence time in the oceans would create more acidity. The increased acidity would likely kill marine life, giving off more carbon, and further increasing the acidity (positive feedback).

The increase in  $\text{CO}_2$  in the atmosphere would likely be accompanied by an increase in temp. If the atmospheric temp went up, so would the temp of the oceans. Warm water holds less  $\text{CO}_2$  than cold water because the molecules are moving faster, so it might become less acidic/hold less  $\text{CO}_2$  (negative feedback).



**25**

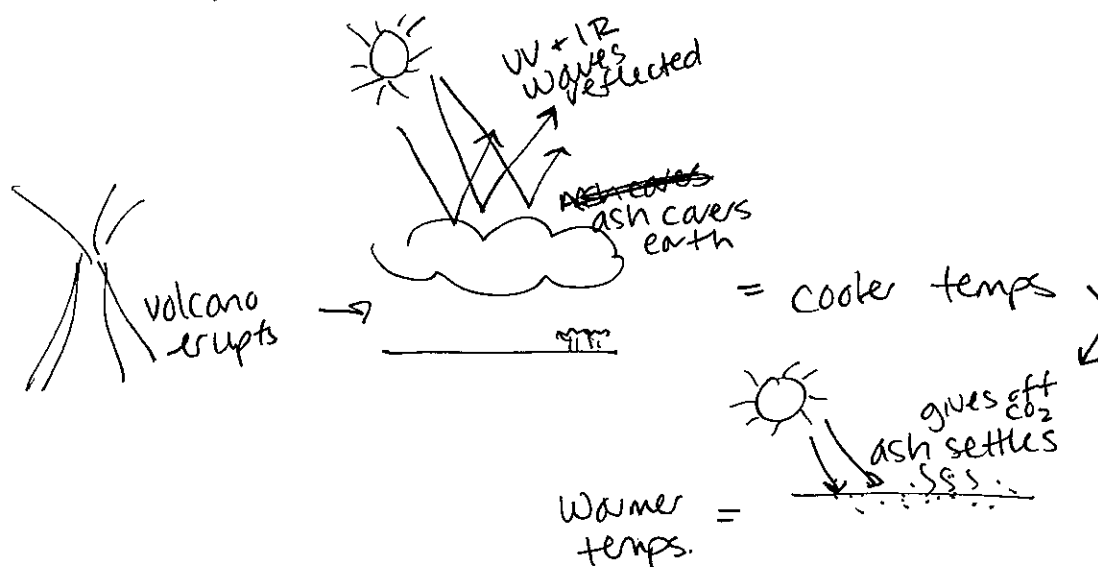
**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Greenhouse gases (water vapor, methane, +  $\text{CO}_2$ ) occur naturally, however, human activity—like the burning of fossil fuels—has increased the amount of greenhouse gases. The gases essentially trap UV + IR rays that would normally be reflected back into the atmosphere, warming the planet. If a volcano ash increased dramatically, initially it would cool the earth—the cloud of ash would block UV + IR rays from reaching the earth. However, eventually the ash would settle out of the atmosphere and leave behind  $\text{CO}_2$ , a greenhouse gas. The increase in  $\text{CO}_2$  + the lack of ash cover would increase temps dramatically.



**Extra credit (2 points).**

How are evaporation and degassing similar and/or different?

- Evaporation is the state change from liquid  $\text{H}_2\text{O}$  to water vapor.  
 Degassing is when a liquid lets off water vapor but is not

Earn up to 1 additional point on your course grade

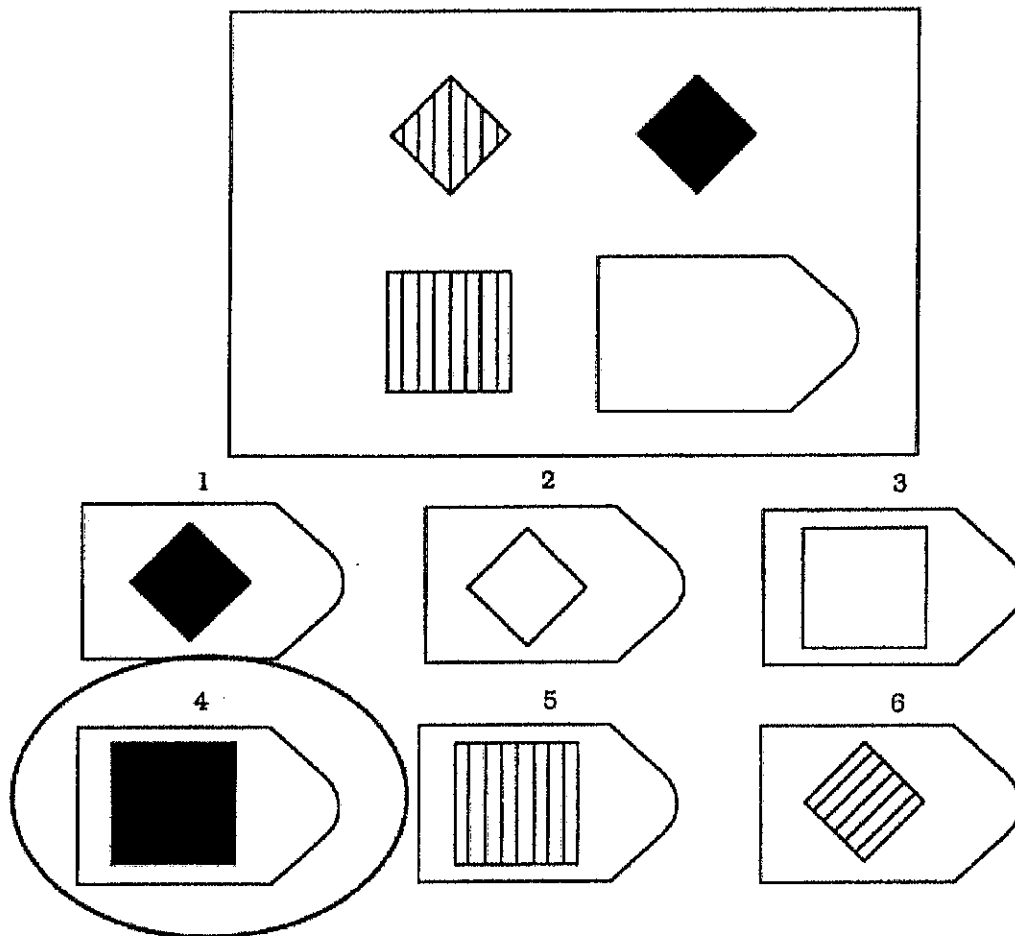
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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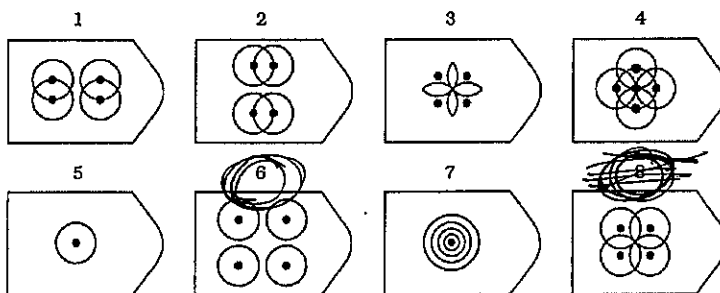
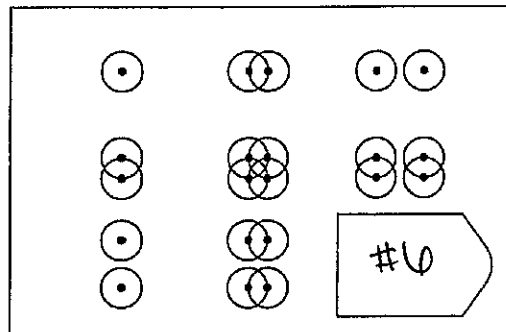


**Answer: 4**

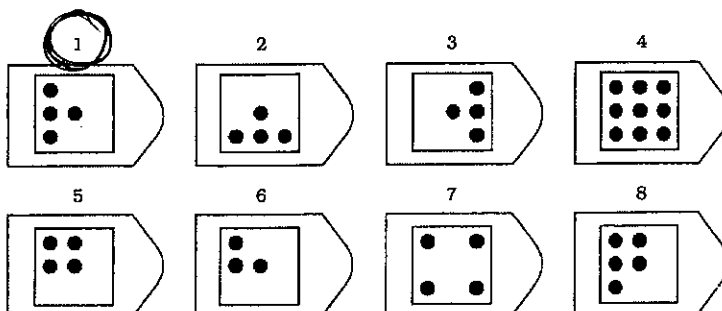
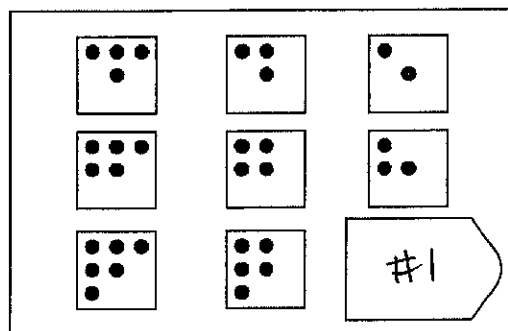
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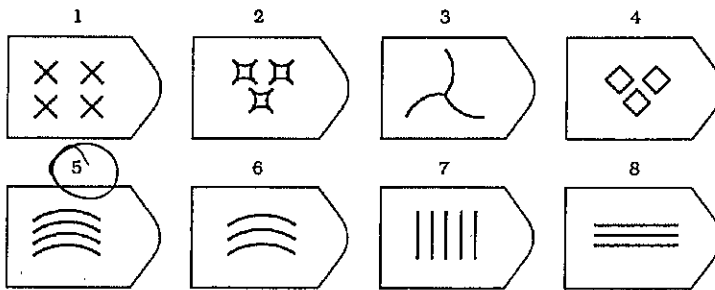
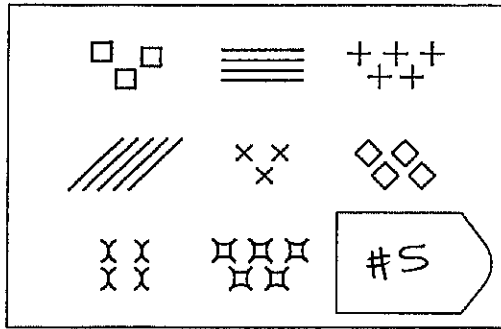
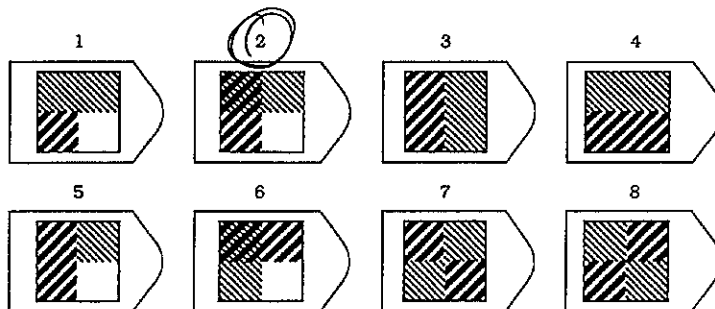
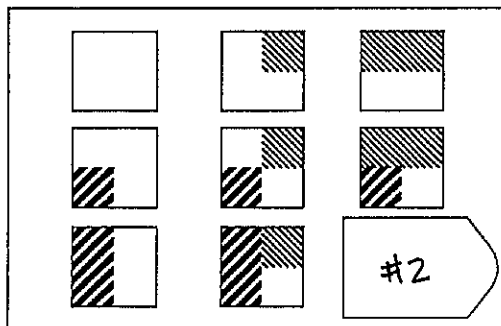
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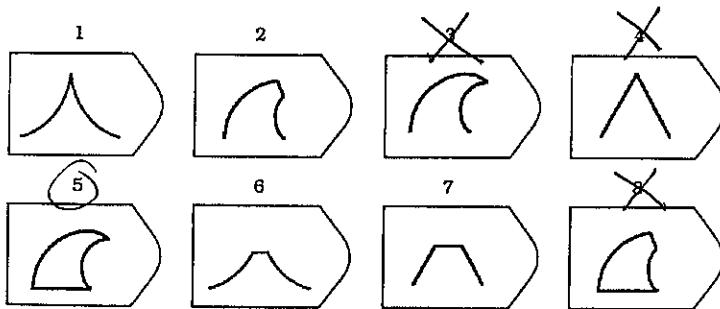
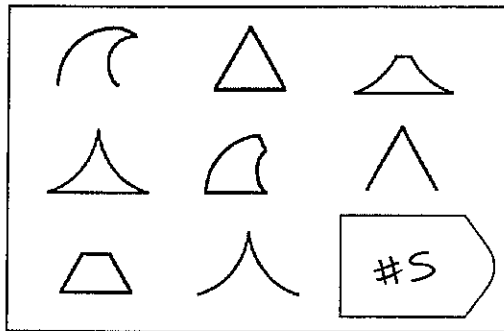
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

- B 1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.
- ~~A. While debugging their broken firewall, a programmer came across top-secret CIA files.~~
  - ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
  - C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
  - D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.
- A 2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week
- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
  - B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
  - C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
  - D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.
- D 3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.
- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
  - B. Bob was able to maximize his work time by cutting back on watching TV during the day.
  - C. Sean has been closely monitoring his eating in an attempt to improve his diet.
  - ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.
- C 4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.
- A. After eating a big lunch, Dan went back to his office and took a nap.
  - B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
  - ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
  - D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

- ☒ 5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.
- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - ☒ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

- ☒ 1. Getting drunk is like...
- A. Getting high. They are both involve too much of a chemical influencing the body.
  - B. Hitting your head. They both involve something that causes headaches.
  - C. Being sleep deprived. They both involve impaired functions.
  - ☒ D. Eating too much candy. They both involve lack of self-control.
  - E. Sleeping late. They are both caused by lack of self-control.
- ☒ 2. Water freezing is like...
- A. Dew forming. They are similar because they both involve a drop in temperature.
  - B. Blowing up a balloon. They are similar because they both involve becoming less dense.
  - ☒ C. Clouds forming. They are similar because they both involve a phase change.
  - D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 49454

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A40518651  
Version B


GROUP: T5

83

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder  
☒ b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. <sup>influx of A = influx = B</sup> Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- $\frac{1000}{100} = 10$        $\frac{1000}{50} = 20$
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- 

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

3

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

ocean acidification occurs when  $\text{CO}_2$  enters the ocean and raises the pH of the ocean, making it more acidic. An increase in atmospheric  $\text{CO}_2$  would cause ~~more~~ an increase in  $\text{CO}_2$  entering the ocean - this is a positive feedback loop. ~~more~~  $\text{CO}_2 + \text{water} = \text{carbon dioxide entering the ocean, causes } \text{HCO}_3^- + \text{H}^+ = \text{ocean acidification}$  more  $\text{CO}_2$  entering the water leads to more ocean acidification. (feedback) More  $\text{CO}_2$  in the atmosphere would also cause the ~~atmosphere~~ ocean temperatures to rise (another positive feedback loop), this warming would ~~not cause~~ allow the ocean to absorb the  $\text{CO}_2$  entering the ocean, thus contributing to ocean acidification. Although warm water is able to absorb  $\text{CO}_2$ , colder water is a better absorber of  $\text{CO}_2$ . ✓

more ocean acidification leads to the destruction of coral reefs, which would kill much of the ecosystem that depends on that.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect is a process by which the Earth's atmosphere heats up by solar energy. The sun emits visible light, this is not absorbed as it passes through the Earth's atmosphere, so it hits the Earth's surface, where it is either reflected back into outer space, not contributing to the warming of the atmosphere, or it is absorbed by the Earth's surface. The absorbed visible light is converted to infrared, or also known as "heat" energy. This infrared energy is reflected into the atmosphere, where greenhouse gases absorb most of it. When the greenhouse gases absorb this infrared energy they become excited and re-emit it in all directions, some going back to the Earth's surface where it either gets reflected or reabsorbed and re-emitted. This is the "trapping" cycle that contributes to the ~~war~~ global warming.

If volcanism on Earth suddenly increased dramatically, erupting large amounts of ash, less solar energy would reach the Earth's surface because it would not be able to get through the ash cloud <sup>in the atmosphere</sup>. This would make the global temperature <sup>25</sup> colder. But the ash would eventually settle out and ultimately make the global temperatures warmer, because there would be a larger amount of CO<sub>2</sub> in the atmosphere from all the volcanic ash. More CO<sub>2</sub> in the atmosphere means higher temperatures (positive feedback loop). Even though initially the temperatures would drop, once the ash settled out and more CO<sub>2</sub> was entering the atmosphere, the temperatures would still be higher than normal because the CO<sub>2</sub> levels would be higher than **Extra credit (2 points)**. natural levels of it.

How are evaporation and degassing similar and/or different?

Evaporation and degassing both involve the breakdown of substances being released into the atmosphere.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

Earn up to 1 additional point on your course grade

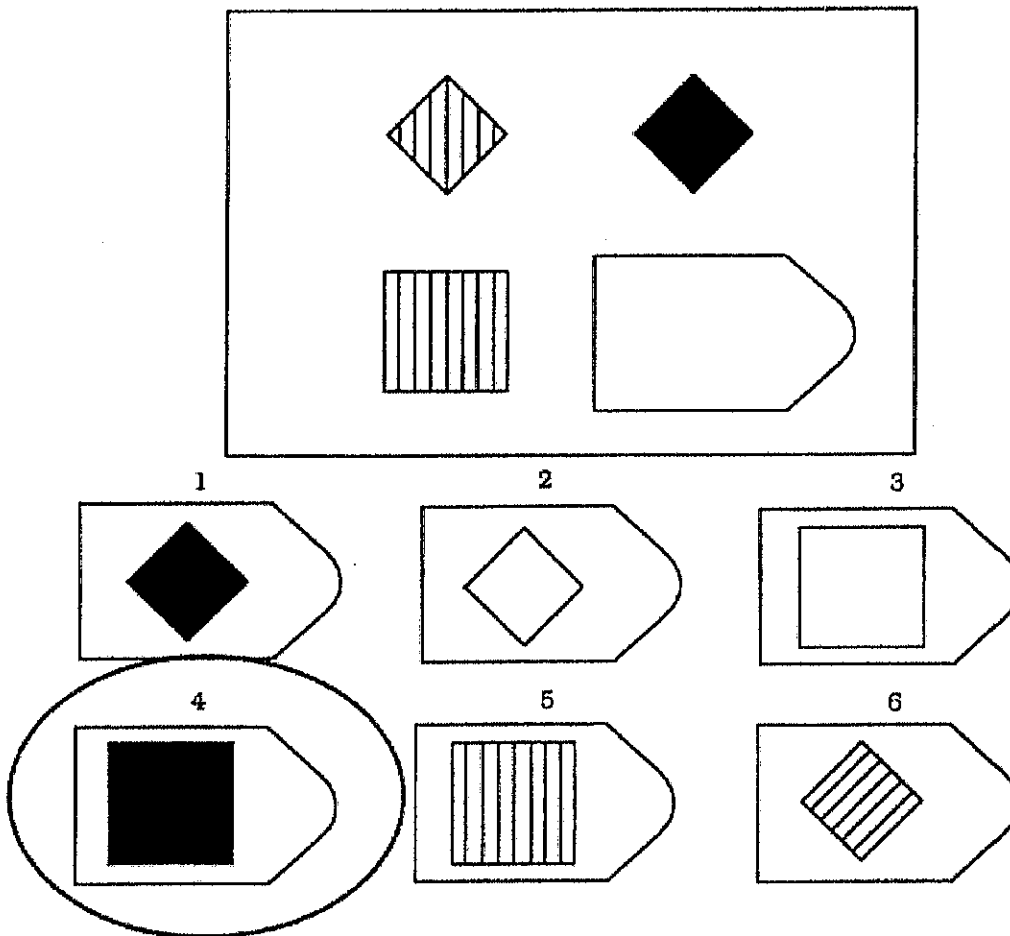
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



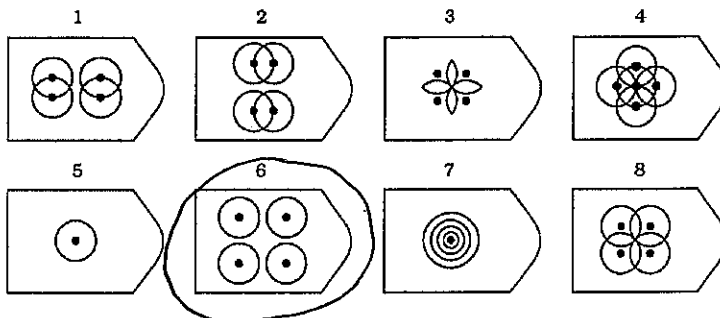
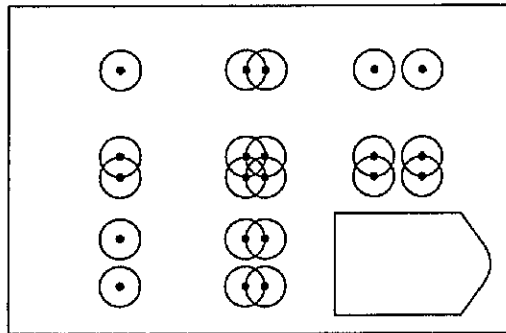
**Answer: 4**

PLEASE CONTINUE ON NEXT PAGE



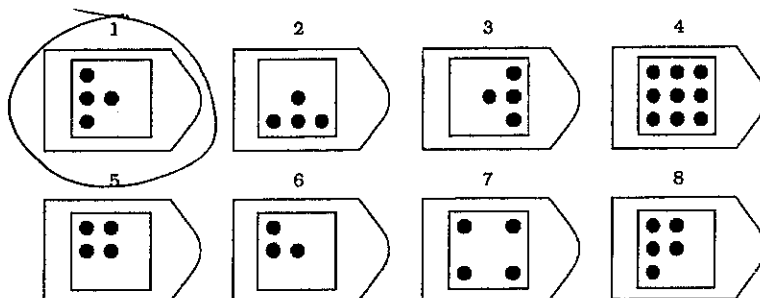
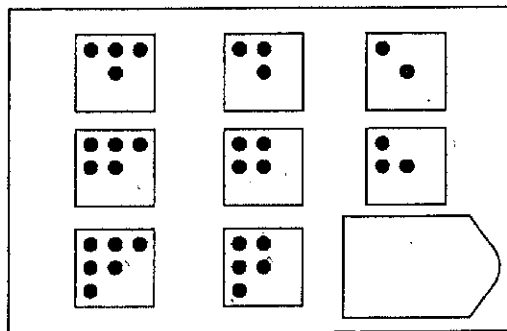
Please choose the image that best completes each of the following patterns.

### PATTERN 1



Answer: 6

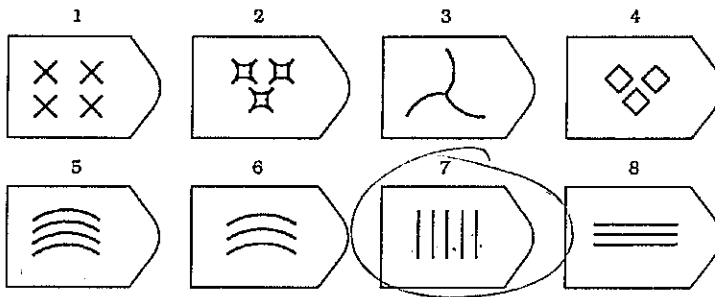
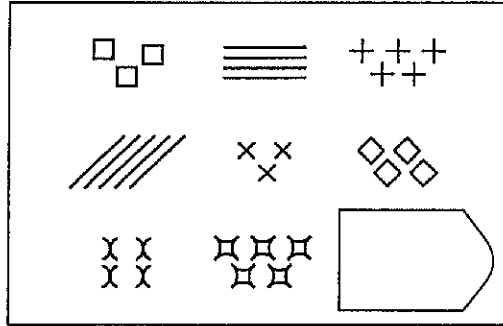
### PATTERN 2



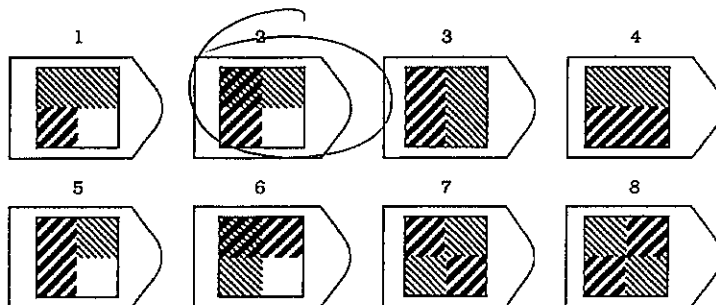
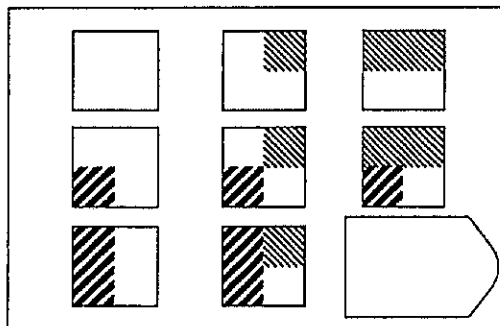
Answer: 1

PLEASE CONTINUE ON NEXT PAGE

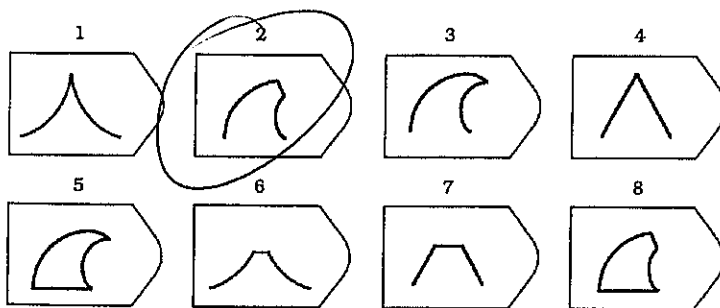
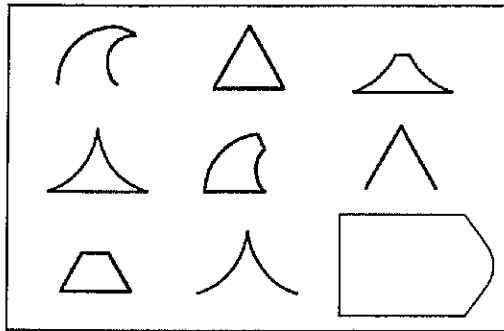
## PATTERN 3

Answer: 7

## PATTERN 4

Answer: 2

## PATTERN 5



Answer: 2

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- ☒ C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - ☒ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48105

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

82

1

STUDENT NAME: A42190700

GROUP: T5

Version B

- I was in your office  
before class

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

a. The reservoir will eventually disappear.

b. The reservoir is not in equilibrium. ✓

c. The reservoir is growing smaller.

d. The reservoir's residence time is 10 years. ✓

1000/100

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

a. The Earth's atmosphere would become colder than it is today.

b. The Earth's atmosphere would become warmer than it is today.

c. The Earth's atmosphere would remain about the same temperature as it is today.

d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

a. Reflection of more solar radiation, causing atmospheric temperature to decrease ✓

b. Reflection of more solar radiation, causing atmospheric temperature to increase

c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase

d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

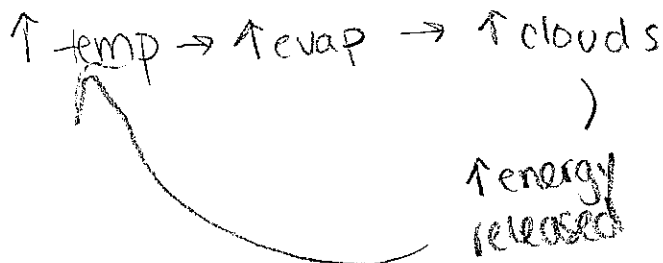
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.

b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.

c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.

d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



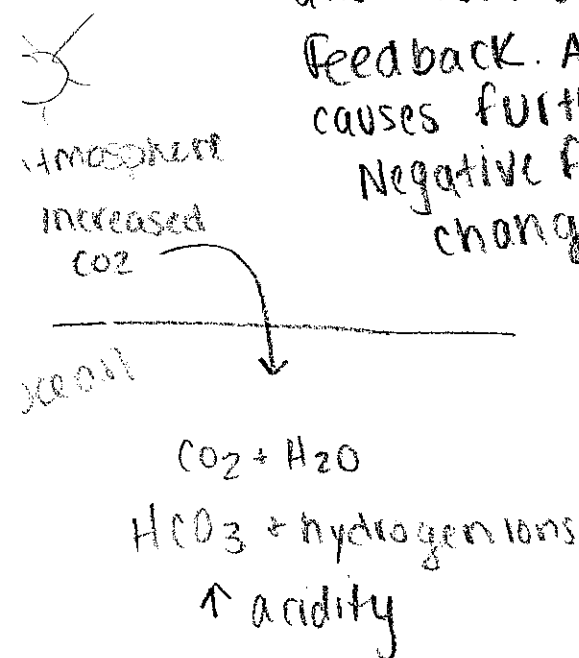
**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

When there is an increased amount of  $\text{CO}_2$  in the atmosphere, this leads to increased levels of  $\text{CO}_2$  in  $\text{H}_2\text{O}$  or the oceans. The combination of this leads to  $\text{HCO}_3^-$  and hydrogen ions. The amount of hydrogen ions (concentration) is the cause of the acidity in the ocean. Warm water can't hold as much acidity and  $\text{H}^+$  will then be released in the atmosphere causing a temperature increase and more  $\text{CO}_2$ . This would be a positive feedback. A positive feedback is a change that causes further change in the same direction. Negative feedback is when a change leads to a change in the opposite direction.



$\uparrow \text{CO}_2$   
in atm

$\uparrow \text{CO}_2$   
in water

$\uparrow \text{acidity}$

20



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

4

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Volcanism, especially, huge ash clouds would affect atmospheric temperature by decreasing it. The cloud cover would block incoming solar radiation or visible light from reaching Earth. Usually the greenhouse effect deals with visible short wavelength light reaching the Earth's surface. Here it can be absorbed and re-emitted as long wavelength infrared radiation.

Some of this goes back into space and doesn't heat the atmosphere or it is absorbed by greenhouse gases and re-radiated toward Earth. This process keeps the infrared radiation and heat trapped in the atmosphere. This would cause temperatures to increase. Even with volcanism we would still have effect of greenhouse gases on atmospheric temperature because they are trapped.

25

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different? Evaporation is water changing from liquid to gas. Degassing deals with the release of carbon as in gas in a solution becoming gas in the atmosphere.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

Earn up to 1 additional point on your course grade

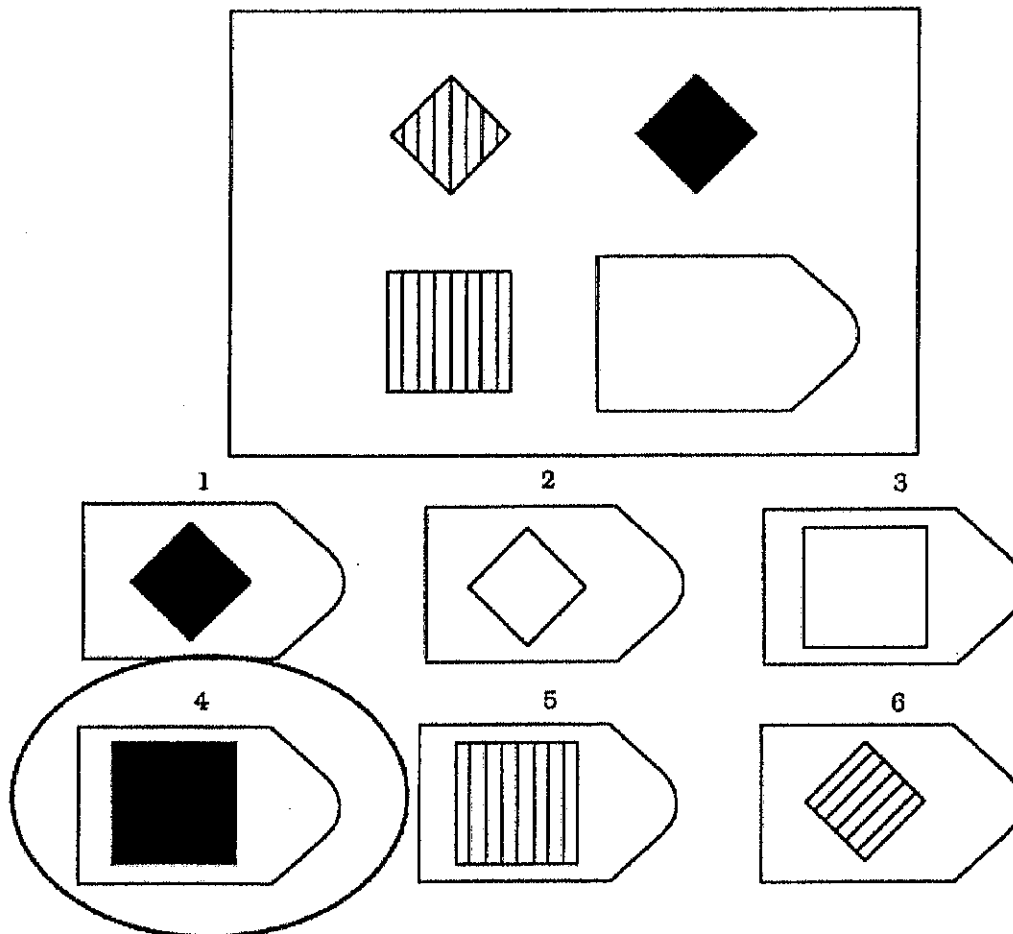
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

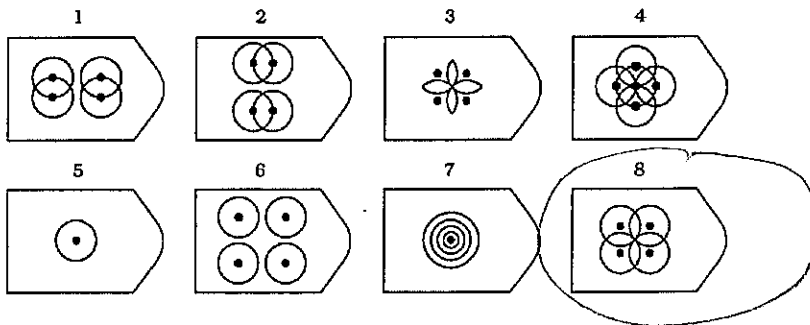
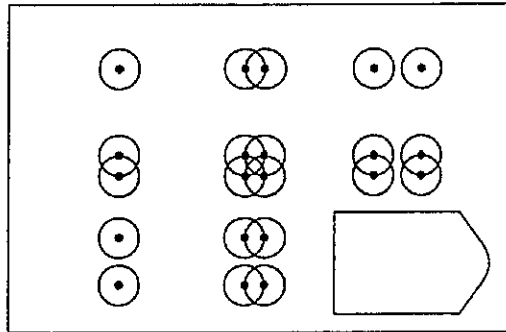
*Example*



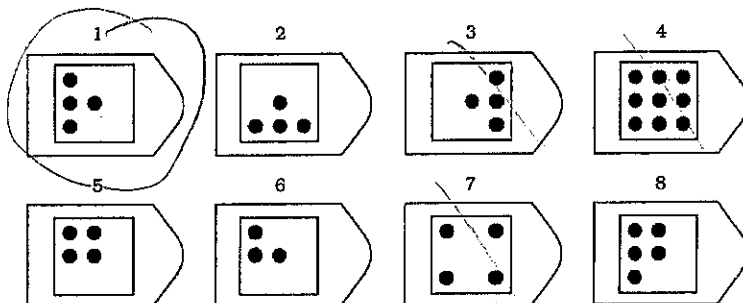
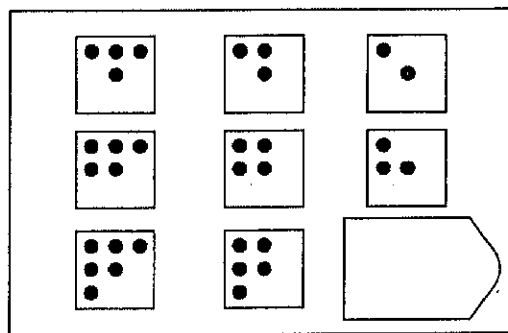
**Answer: 4**

Please choose the image that best completes each of the following patterns.

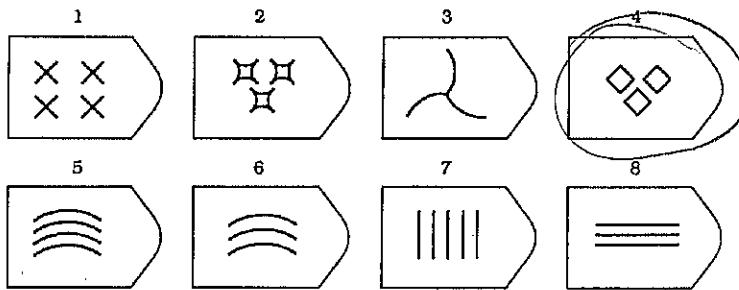
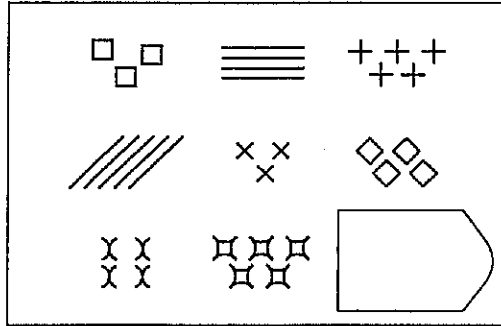
**PATTERN 1**



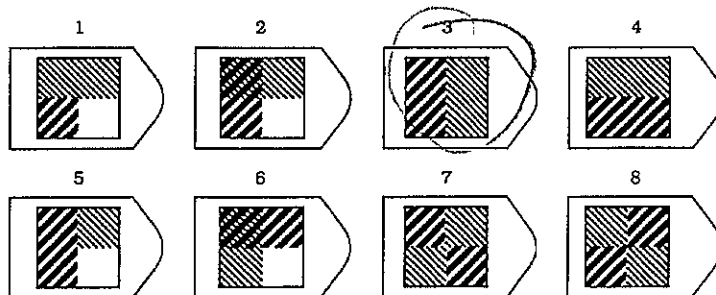
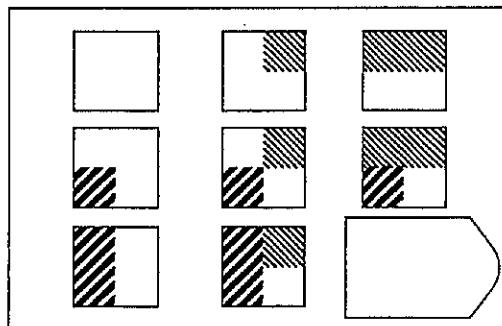
**PATTERN 2**

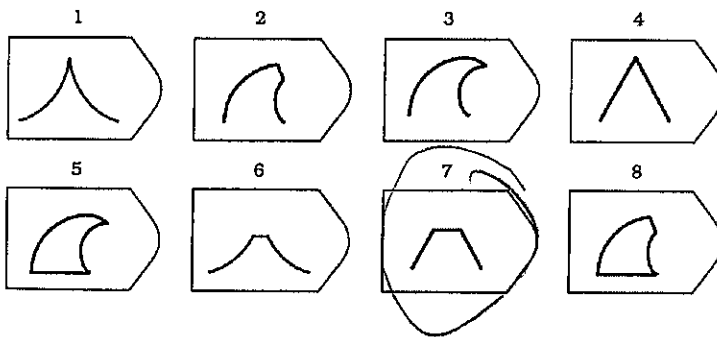
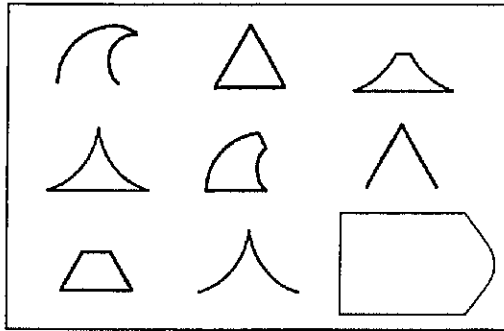


**PATTERN 3**



**PATTERN 4**



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

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B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
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- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48026

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 41503028

GROUP: T5

Version B

73

MULTIPLE-CHOICE. 5 points each (50 points total).

results in opposite

1. Which of the following would be considered a negative feedback to increasing global temperature?

- A
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere

2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder - can crystallize & stop
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter - allows to pass thru but not make it actually rise
  - d. Crystals forming in the magma - stops

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- C
- a. A = erosion, B = deposition, C = uplift and erosion
  - b. A = erosion, B = biochemical precipitation, C = uplift and deposition
  - c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d. A = dissolution, B = deposition, C = uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- C
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.

5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- 1 = 10  
3 = 5  
ux = 2  
10/2 = 5  
= 2.5
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

A & B outflow & influx are =  
RT = amount / flux

6. Which of the following would cause the acidity of Earth's oceans to decrease?

- C
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

less CO<sub>2</sub> then  
less acidic

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

| R    | IN  | OUT |
|------|-----|-----|
| 1000 | 100 | 50  |

- ☐ a. The reservoir will eventually disappear.  
☐ b. The reservoir is not in equilibrium.  
☒ c. The reservoir is growing smaller.  
☐ d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☐ a. The Earth's atmosphere would become colder than it is today.  
☐ b. The Earth's atmosphere would become warmer than it is today.  
☒ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

surface of ice reflects as IR

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

- clouds form & E is released

- more clouds more E released!

- Temp goes up & this process continues  
or accelerates temp increase so pos. feed.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

• accelerates  
• decelerates  
• dampens  
changes

- More  $\text{CO}_2$  in atmosphere, more  $\text{CO}_2$  in ocean
- More  $\text{CO}_2$  in ocean will increase acidification & pH levels (positive feedback)
- More acidic an ocean, the greater risk of killing coral reefs & disrupting food chain/life cycle. (positive feedback)
- The higher  $\text{CO}_2$  levels in ocean result in acid rain because when the highly acidified ocean is evaporated, it precipitates as acid rain. (positive feedback) X
- When  $\text{CO}_2$  is evaporated, it adds to the atmosphere (& initially the greenhouse effect). By doing so the Earth's atmospheric temperatures will increase, which increases ocean temps.
- Thus, due to the fact ocean acidification results in cooler waters, when  $\text{CO}_2$  levels heat Earth's atmosphere & warm ocean, the ocean warms which decreases ocean acidification! (negative feedback)

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The greenhouse effect occurs when the sun releases energy (visible light). Some of this energy is reflected back into space from clouds, ice, + oceans. However, a lot of this energy reaches the Earth's surface + is absorbed. It is then radiated back into the atmosphere as IR. The energy then becomes "trapped" by gases such as water vapor + CO<sub>2</sub>. These gas's molecules then become "excited" + shoot out the energy back into the atmosphere, thus, warming the surface where the process happens again. ~~when we~~ add ash clouds to the atmosphere, it blocks some of the initial first step of the sun's energy reaching the Earth's surface. Thus, we feel the atmospheric temperature cooling. However, gases are still "trapping" the IR rays, and so it is hard to tell if the volcanic ash actually results in an increase or decrease of overall atmospheric temperature, and how much the levels of ash decelerate or accelerate the greenhouse effect. [the role of all Earth's other positive + negative feedbacks makes it extremely difficult to determine atmospheric temperature increases/decreases]

25

Extra credit (2 points).

X How are evaporation and degassing similar and/or different? evaporation is the process of liquid to a vapor/gas. ~~then it is "lost"~~ and become another element

Earn up to 1 additional point on your course grade

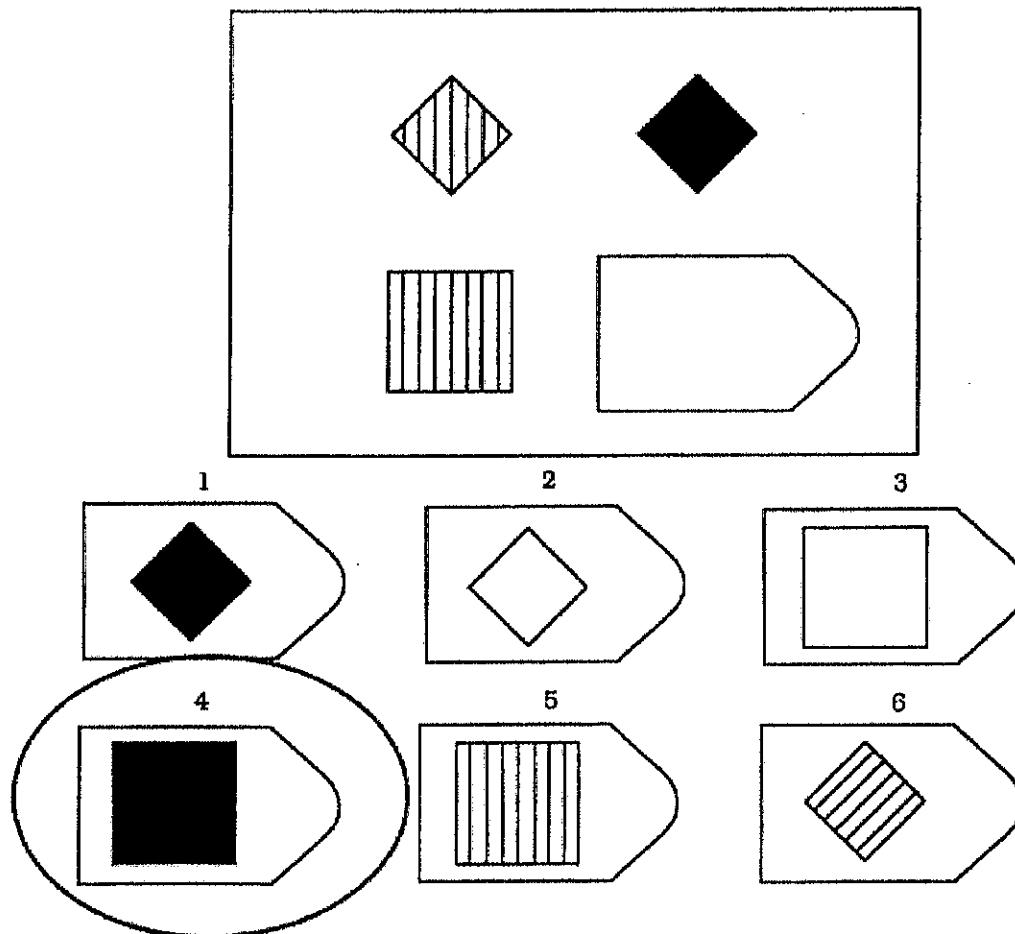
[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

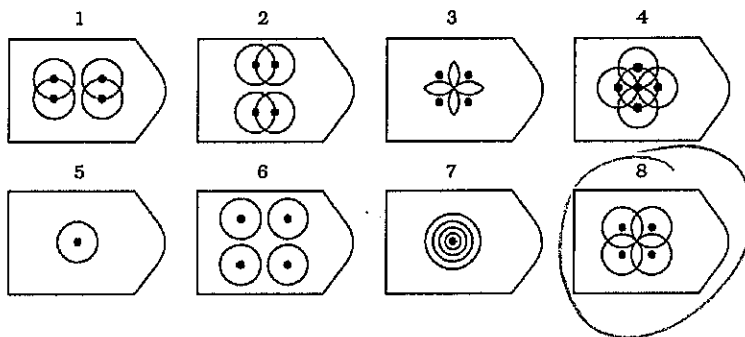
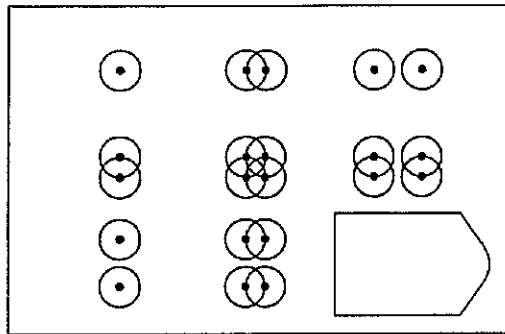


**Answer: 4**

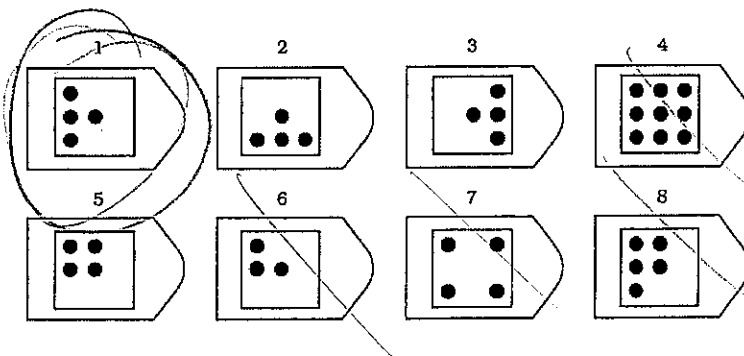
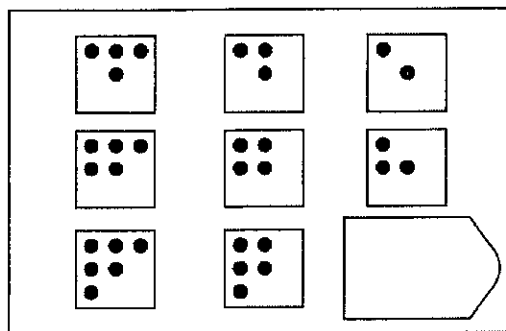
PLEASE CONTINUE ON NEXT PAGE

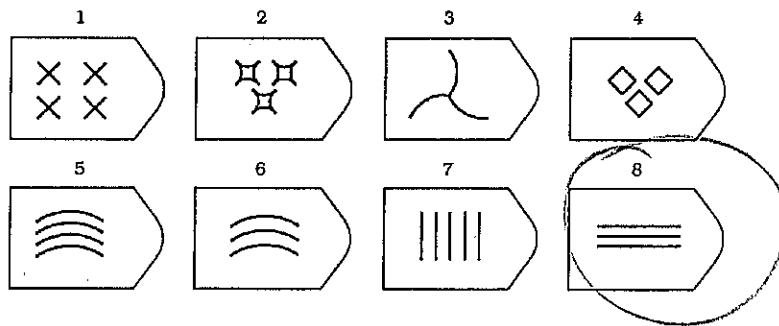
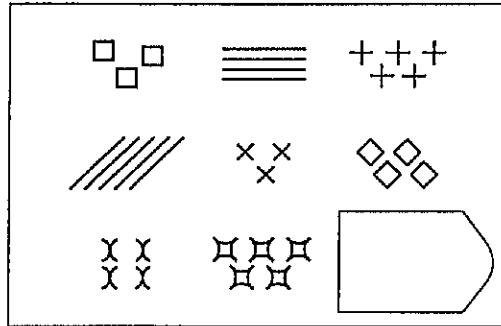
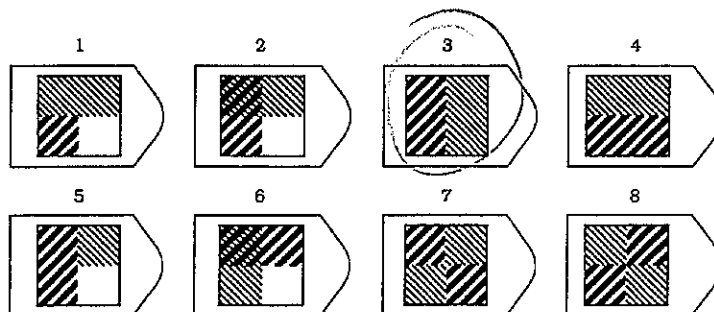
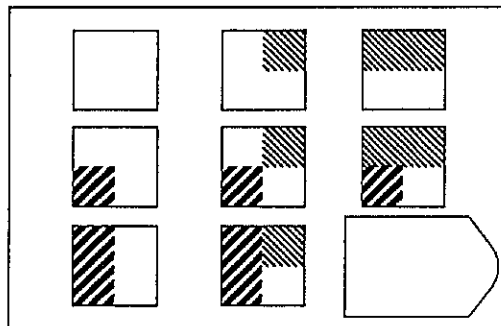
Please choose the image that best completes each of the following patterns.

### PATTERN 1

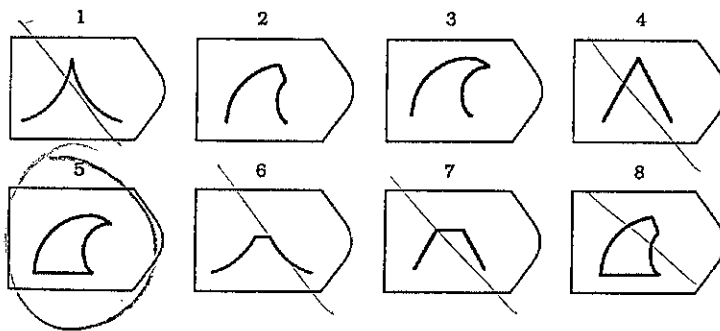
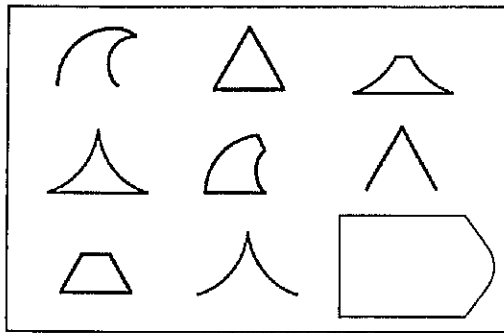


### PATTERN 2



**PATTERN 3****PATTERN 4**



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

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PLEASE CONTINUE ON NEXT PAGE

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2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

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PLEASE CONTINUE ON NEXT PAGE

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- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
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- 

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- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
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2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
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## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48823

What is your gender?

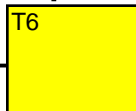
- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A43864729  
Version A

GROUP:



15

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- A
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- A
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- A
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- C
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- ☒ a. The reservoir will eventually disappear.
  - ☐ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- D
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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- ☐ a. The Earth's atmosphere would become colder than it is today.
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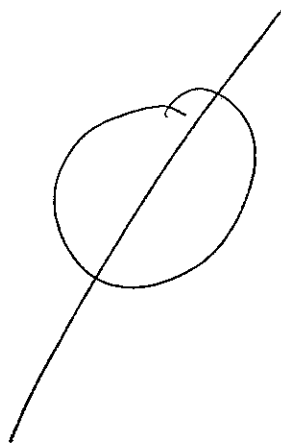
**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

the increase in atmospheric carbon dioxide will affect ocean acidification both ~~positively~~ with both positive and negative feedback. the temperature will rise due to the  $\text{CO}_2$  being emitted into the atmosphere. Ocean acidification will change both negatively and positively



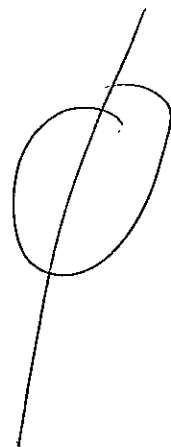
2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

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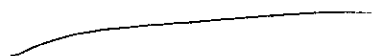
The process would both positively and negatively affect earth's atmospheric temperature through the natural process related to volcanism you get a green house effect that emits toxins into the air which causes a natural increase in atmospheric temperature. It is through this that the natural processes from the sudden increase in volcanism affects the atmospheric temperature.

What?



**Extra credit (2 points).**

How are evaporation and degassing similar and/or different?



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

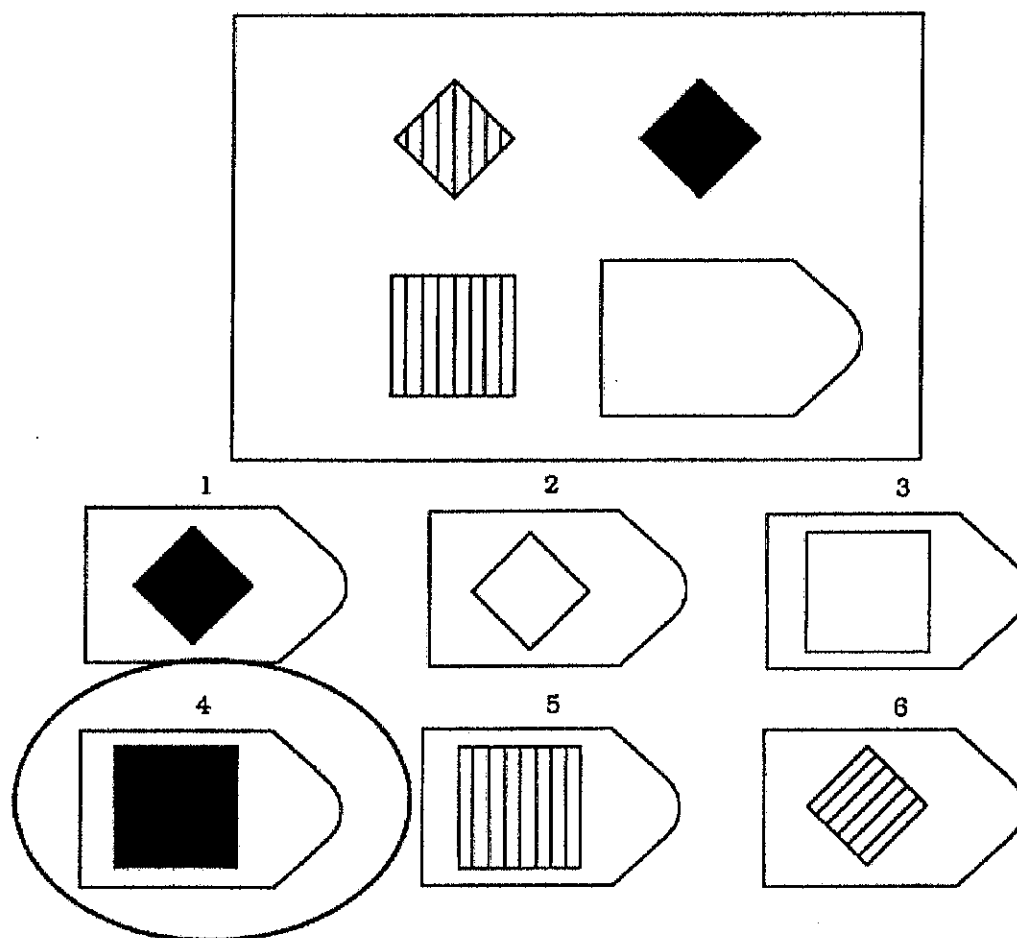
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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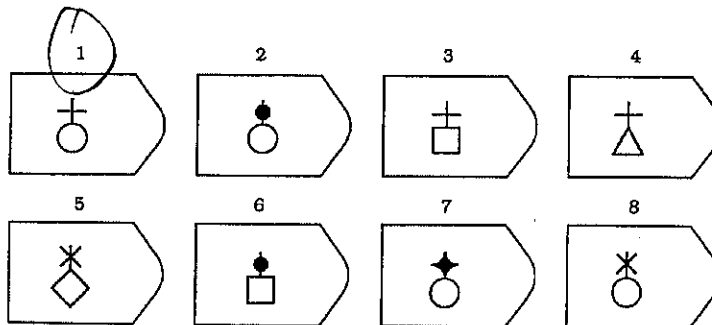
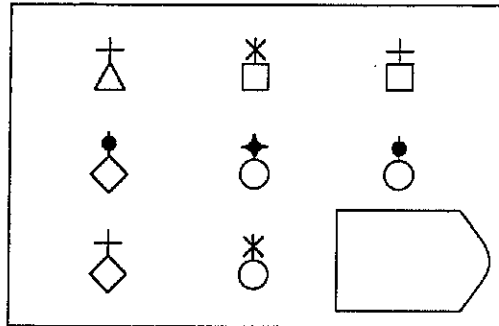


**Answer: 4**

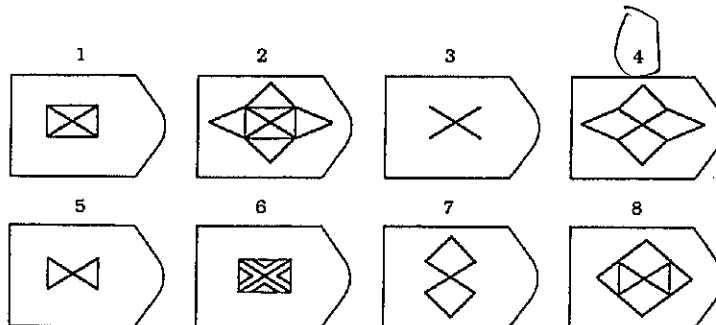
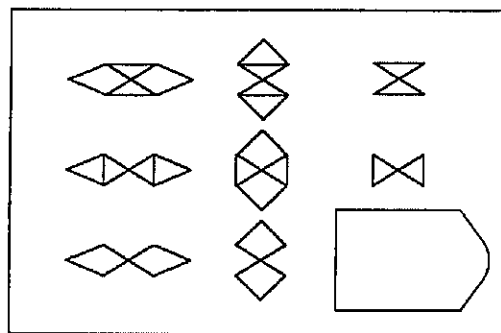
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

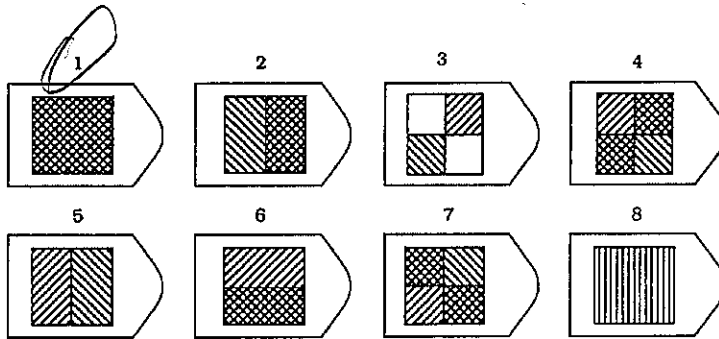
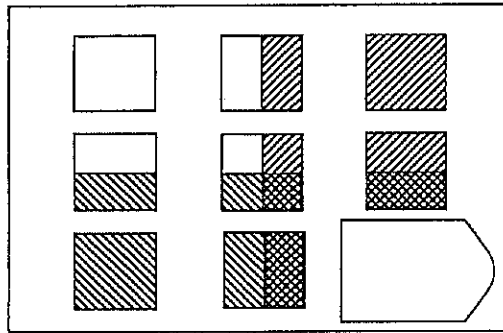
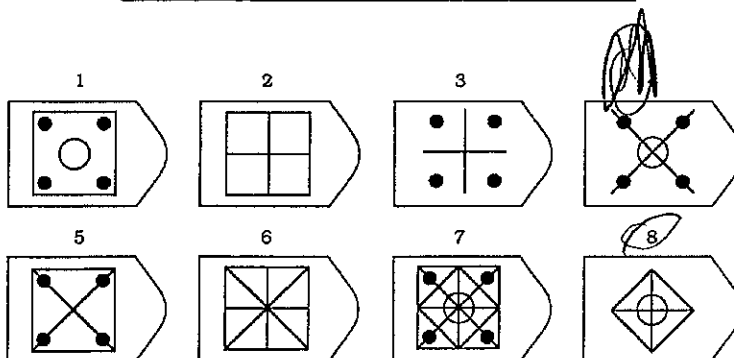
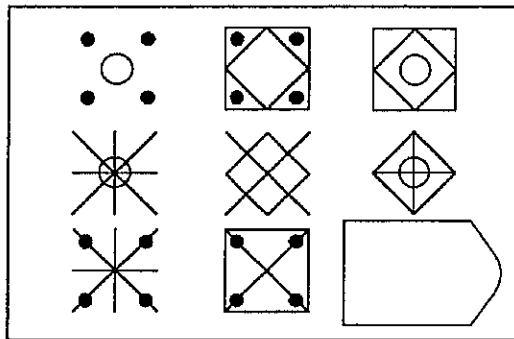
### PATTERN 1



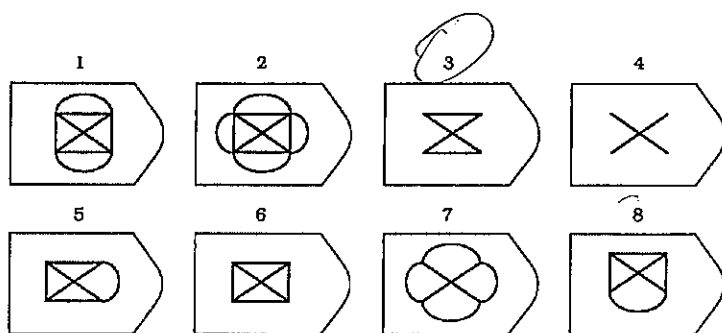
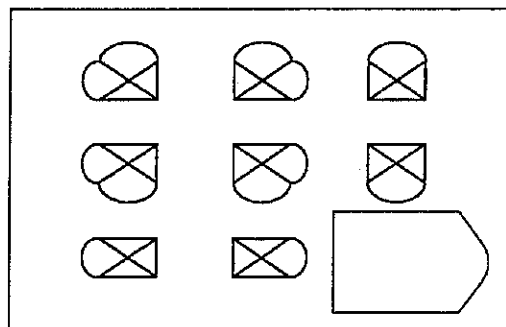
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

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- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

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- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.

A. The plumber fixed the pump that had burst and flooded the basement.

B. Steven avoided midweek outings in order to have the time for a weekend trip out of town

☒ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.

☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.

---

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

A. An ice cube in water. They are similar because they both are less dense than the surrounding material.

B. A leaf in the air. They are similar because they both move through the air carried by the wind.

☒ C. Blowing bubbles. They are similar because they both float until they eventually pop.

D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

A. Getting the flu. They are similar because they are both caused by viruses.

B. Getting pink eye. They are similar because they are both contagious.

C. Getting the flu. They are similar because they are both caused by not washing your hands.

☒ D. Forgetting to do your homework. They are similar because they are both preventable.

E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48823

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☐ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☒ Other Chaldean

STUDENT NAME: A42385484  
Version A

GROUP: T6

85

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder  
B ☒ b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
B ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
C ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
B ☒ b. Natural processes are the primary cause of the greenhouse effect.  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?  
A ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
A ☒ a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.

$$A = \frac{100}{50} = 2 \quad B = \frac{200}{50} = 4$$

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- B ☐ a. The reservoir will eventually disappear.  
☒ b. The reservoir is not in equilibrium.  
☐ c. The reservoir is growing smaller.  
☐ d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- B ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- A ☒ a. The Earth's atmosphere would become colder than it is today.  
☐ b. The Earth's atmosphere would become warmer than it is today.  
☐ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

A) The process of ocean acidification is when carbon dioxide in the air flows into the ocean, the ocean pH level increases. As carbon dioxide leaves the ocean into the atmosphere through ~~evaporation~~, the carbon dioxide is added to the atmosphere.

The equation  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$ , this represents the carbon dioxide ( $\text{CO}_2$ ) being added to the ocean ( $\text{H}_2\text{O}$ ) gives you  $\text{HCO}_3^- + \text{H}^+$  which is the bicarbonate in the ocean (the pH).

B) An increase in atmospheric carbon dioxide will cause an increase in ocean acidification, this will cause the pH level to increase as well as the temp. of the ocean to increase. This is a positive feedback loop.

An increase in atmospheric carbon dioxide will cause an increase in ocean acidification, this will cause the pH level to increase, increasing the ocean temp. Since warmer waters hold less molecules, some of the carbon dioxide in the ocean will ~~evaporate~~ back into the atmosphere causing pH levels to decrease & the temp of the water to decrease as well. This is a negative feedback loop.

25 OK

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

With an increase in volcanism, there is a higher amount of sulfur dioxide being pumped into the atmosphere. This is a result of the ash that is from the volcano erupting. Sulfur dioxide, when in the atmosphere, actually will block out some of the visible light being emitted from the sun. With a fraction of the visible light being blocked, there is less visible light being absorbed & re-emitted as infrared heat & being trapped & re-released into the atmosphere by the greenhouse gases. This will have an immediate impact on atmospheric temp. in which the atmospheric temp. will decrease. The greenhouse effect is when energy from the sun is emitted to earth as visible light. This visible light is either reflected off glaciers back into space as visible light, or it is absorbed by the Earth, then re-emitted as infrared heat. The greenhouse gases in the atmosphere only absorb infrared heat. Once they are absorbed, the gases re-emit the infrared heat in all directions. Some heat is lost into space, while some is absorbed back into the Earth where it is re-emitted again, this is the "trapping" effect.

OK  
25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

---

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

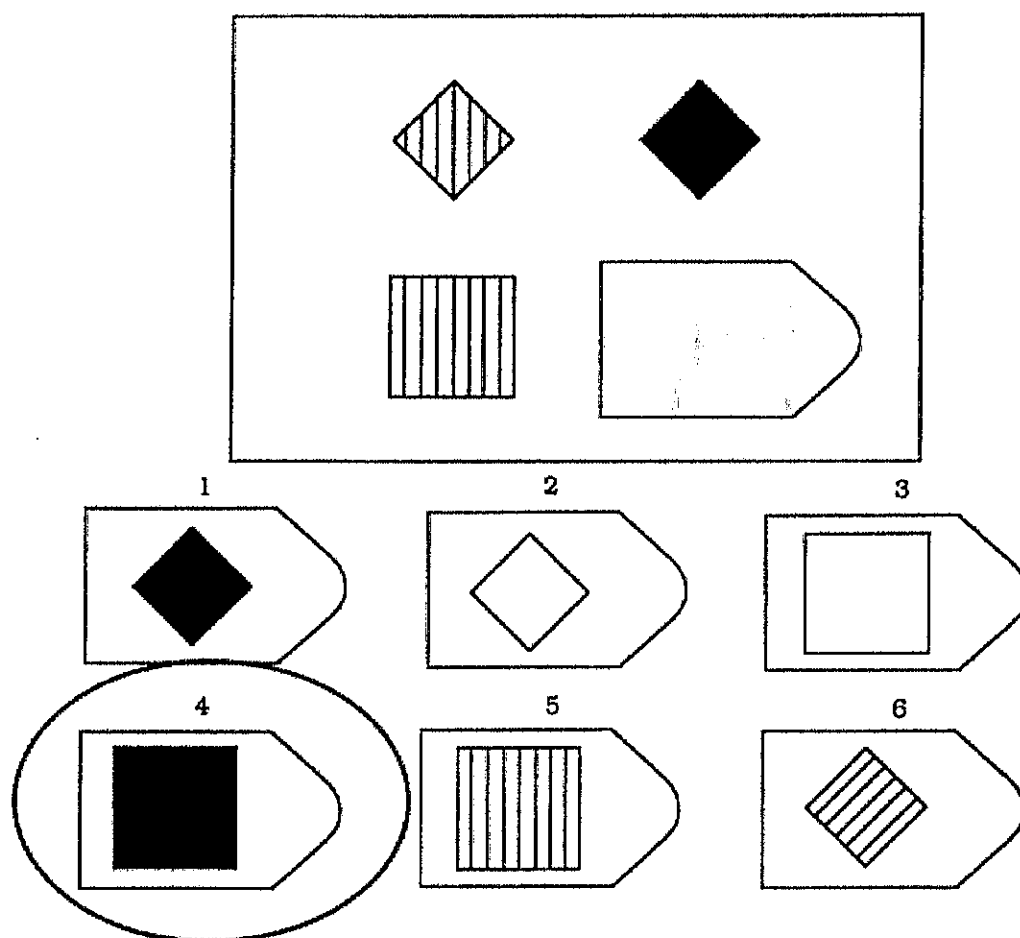
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

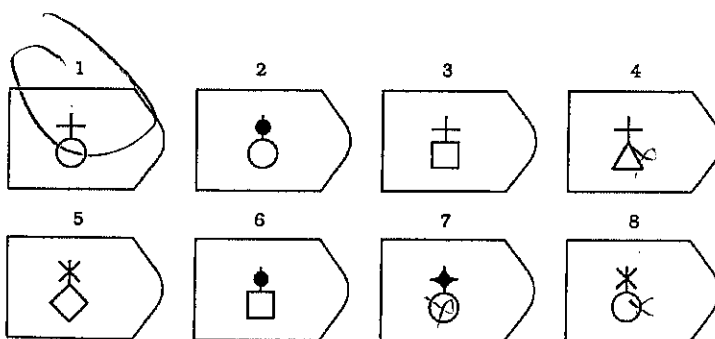
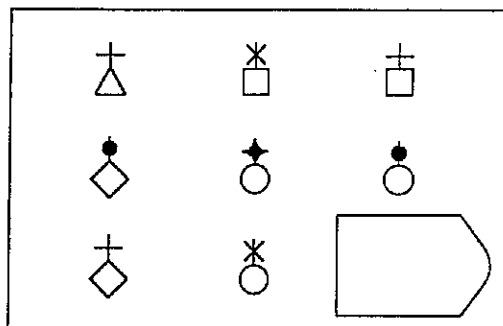


**Answer: 4**

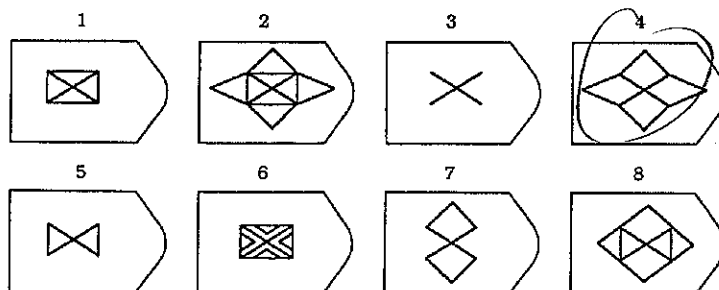
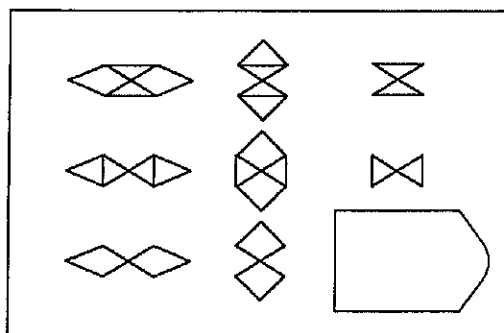
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

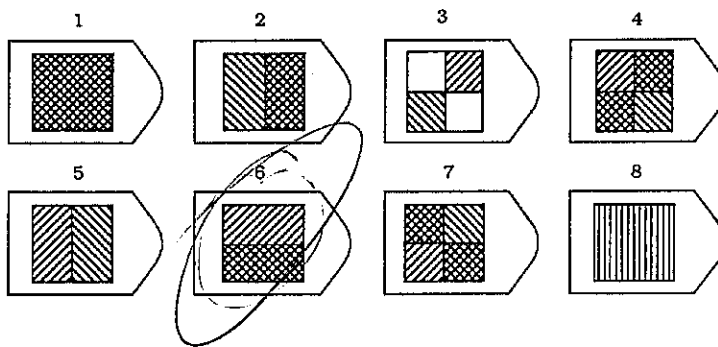
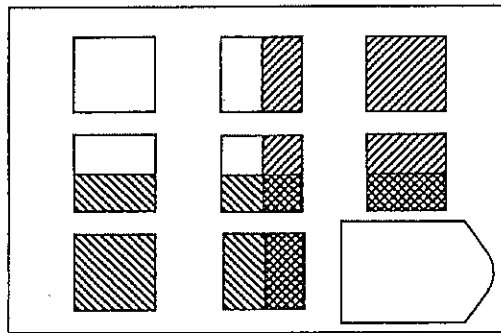
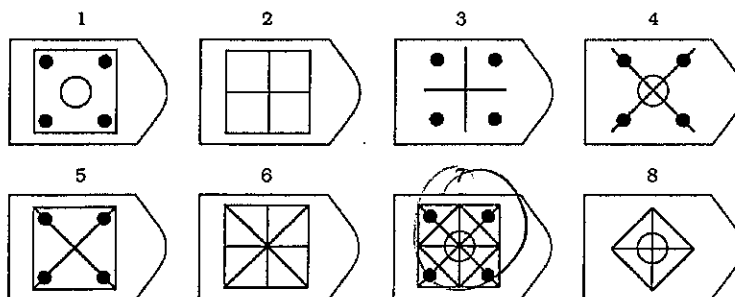
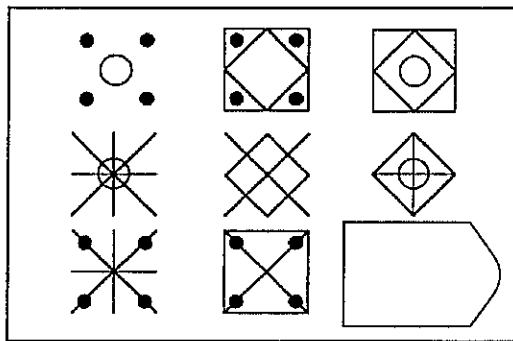
### PATTERN 1



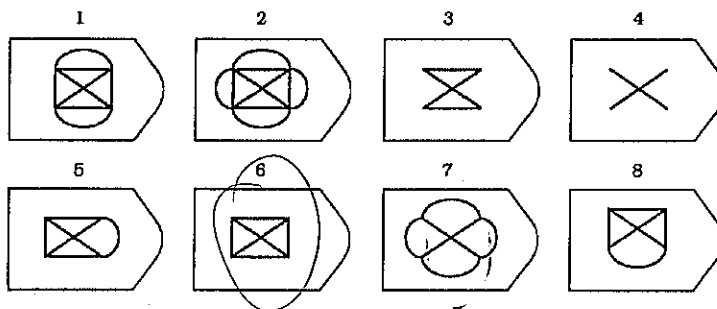
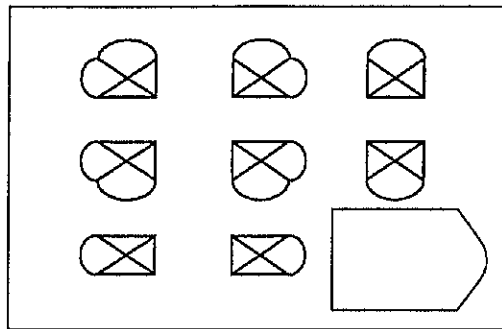
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
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PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

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A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

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PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
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  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
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- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 44316

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A 42766836

GROUP: T6

Version A

**MULTIPLE-CHOICE. 5 points each (50 points total).**

60

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- 14
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- 1C
- a. A= erosion, B= deposition, C= uplift and erosion
  - ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- C
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
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5. Which of the following would cause the acidity of Earth's oceans to decrease?

- B
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
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6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- B
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B**
- ☐ a. The reservoir will eventually disappear.
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  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A**
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- D**
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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- A**
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
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**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

The process of ocean acidification turns  $\text{CO}_2$  gas from the atmosphere and creates a  $\text{H}^+$  ion and  $\text{HCO}_3^-$ . The  $\text{H}^+$  ion makes the ocean more acidic.

\* If the ocean water is cooler, more  $\text{CO}_2$  gas will enter the water and create more acid. An increase in the  $\text{CO}_2$  in the atmosphere would affect ocean acidification depending on the temperature of the water. If the water was cooler more  $\text{CO}_2$  will be dissolved into the water creating a positive feedback loop. If water is higher in temperature then less  $\text{CO}_2$  will be dissolved into the water creating a negative feedback loop.

Δ Ocean acidification uses biochemical precipitation to make  $\text{HCO}_3^-$  and  $\text{H}^+$  ion. Shells and other biomass reacts to  $\text{CO}_2$  and water to make the ocean more acidic because of the  $\text{H}^+$  ions

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

8

When volcanism occurs  $\text{CO}_2$  and other greenhouse gasses are released into the atmosphere increasing the greenhouse effect. The greenhouse effect occurs because infrared rays from the sun hit Earth's surface and are reflected in the sky. Greenhouse gasses trap infrared rays and reflect them back to the Earth's surface heating the Earth. *meaning?*

The volcanism will cause the Earth's temperature to rise because more greenhouse gasses were released into the atmosphere. Because of this increase in greenhouse gasses, the greenhouse effect will increase causing the Earth's atmospheric temperature to rise.

ASH?

**Extra credit (2 points).**

How are evaporation and degassing similar and/or different?

Evaporation is when a liquid changes state to a gas.  
Degassing is when a gas stays in the same state but travels from a liquid to a gas.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

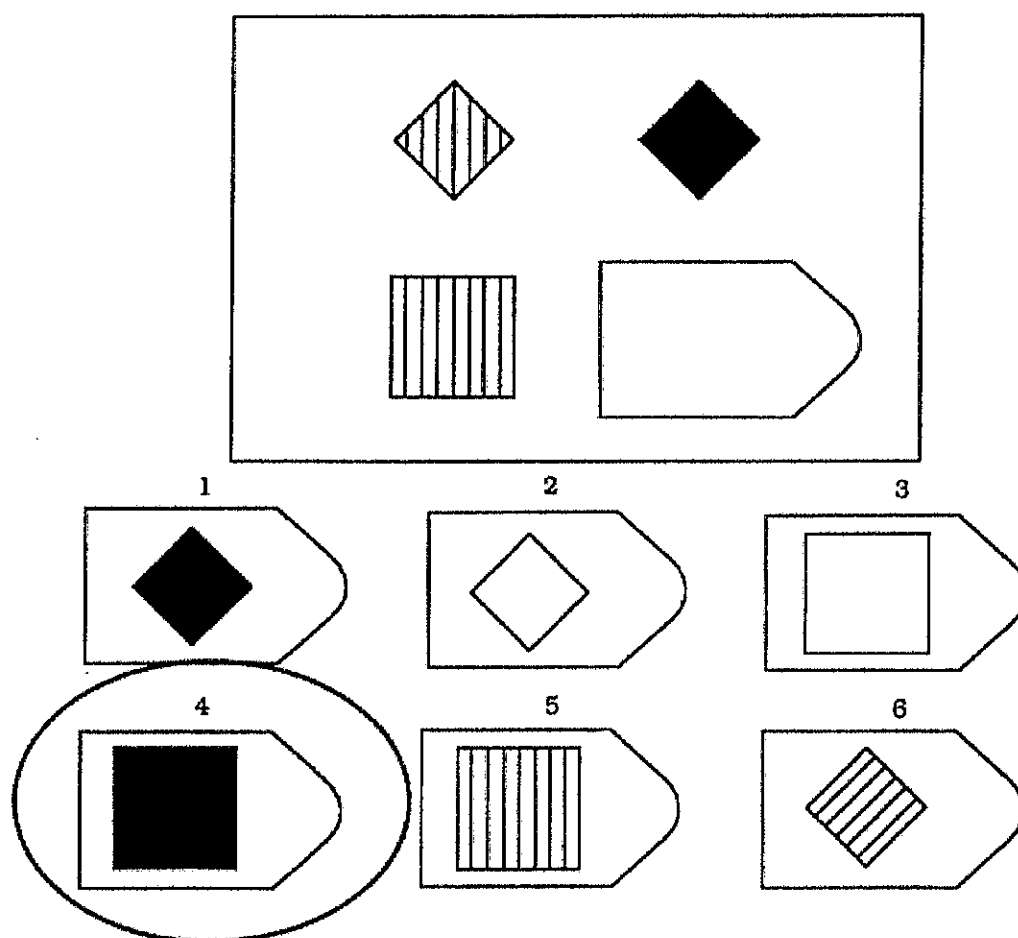




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

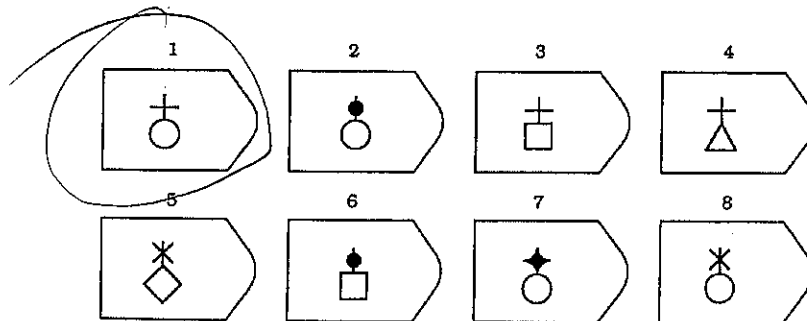
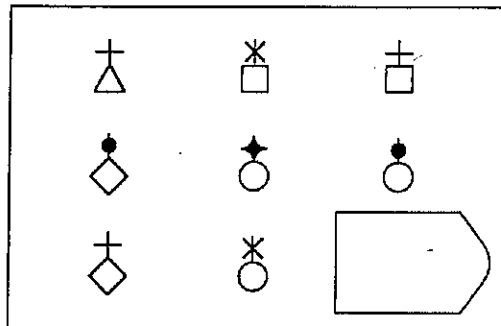


**Answer: 4**

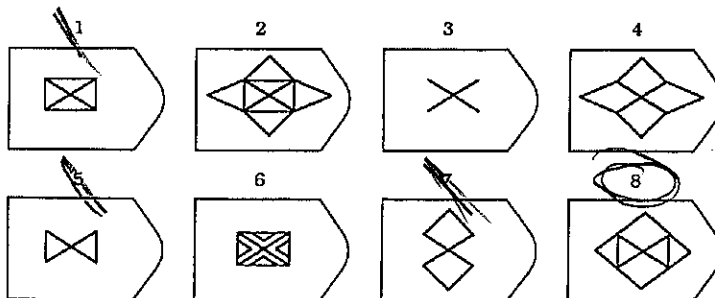
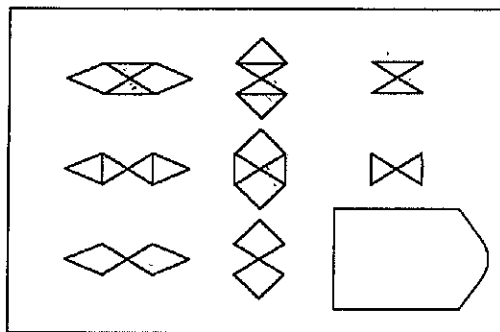
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

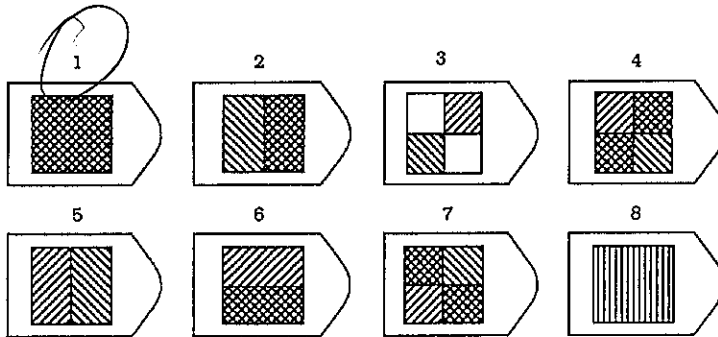
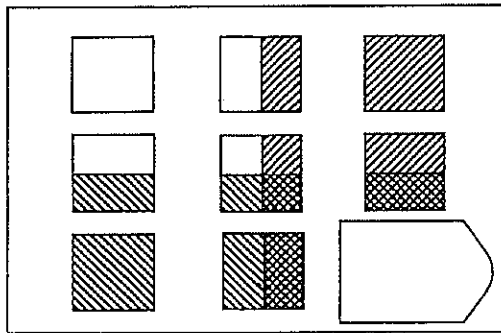
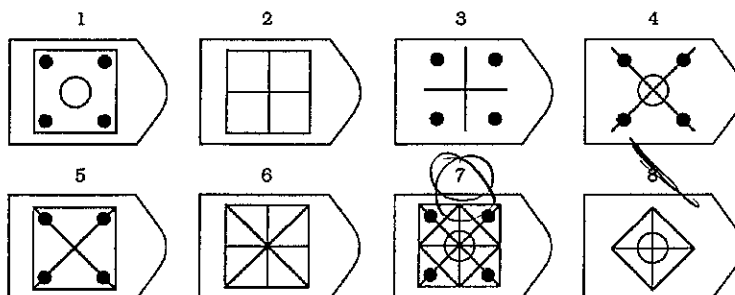
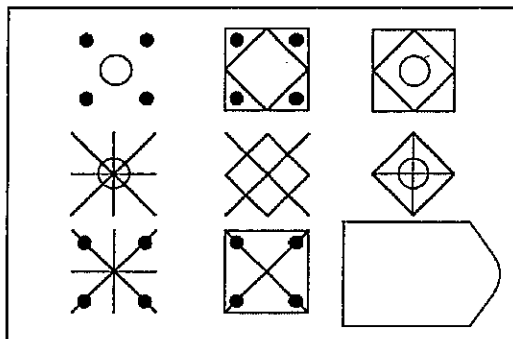
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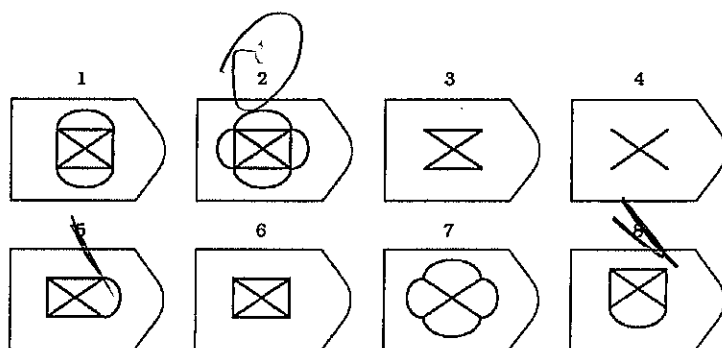
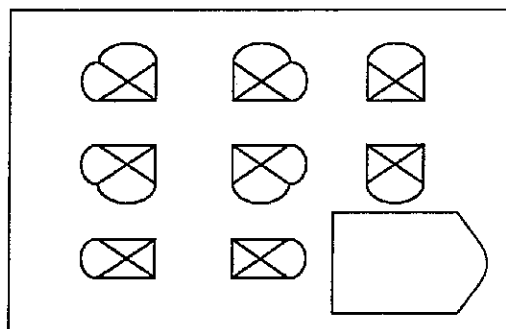
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

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~~A. Before the annual parade, the city council decided to renovate one of the buildings downtown.~~

~~B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.~~

~~C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.~~

☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

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B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

~~C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.~~

~~D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.~~

4. The rival gangs used graffiti to define their territorial boundaries.

~~A. The toddler wrote on the walls with pens when the babysitter wasn't looking.~~

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

~~D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.~~

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ~~A.~~ The plumber fixed the pump that had burst and flooded the basement.
  - ~~B.~~ Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - ~~C.~~ The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- ~~B.~~ A leaf in the air. They are similar because they both move through the air carried by the wind.
- ~~C.~~ Blowing bubbles. They are similar because they both float until they eventually pop.
- ~~D.~~ A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- ~~B.~~ Getting pink eye. They are similar because they are both contagious.
- ~~C.~~ Getting the flu. They are similar because they are both caused by not washing your hands.
- ~~D.~~ Forgetting to do your homework. They are similar because they are both preventable.
- ~~E.~~ Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 60612

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A41450320  
Version A

GROUP: T6

83

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B** ☐ a. The magma becoming colder  
☒ b. Gas bubbles forming in the magma  
☐ c. The surrounding crust becoming hotter  
☐ d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere  
**C** ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- ☒ a. A = erosion, B = deposition, C = uplift and erosion  
☐ b. A = erosion, B = biochemical precipitation, C = uplift and deposition  
**C** ☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion  
☐ d. A = dissolution, B = deposition, C = uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- B** ☒ a. Human activities are the primary cause of the greenhouse effect.  
☐ b. Natural processes are the primary cause of the greenhouse effect.  
☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
☒ d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
☒ e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- A** ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- B** ☒ a. Reservoir A has a shorter residence time than Reservoir B.  
☐ b. Reservoir B has a shorter residence time than Reservoir A.  
☐ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- B ☒ a. The reservoir will eventually disappear.  
☐ b. The reservoir is not in equilibrium.  
☐ c. The reservoir is growing smaller.  
☐ d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase  
☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
B ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- ☒ 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- A ☒ a. The Earth's atmosphere would become colder than it is today.  
☐ b. The Earth's atmosphere would become warmer than it is today.  
☐ c. The Earth's atmosphere would remain about the same temperature as it is today.  
☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

Less  $\text{CO}_2$  in atmosphere would allow  
more radiatio



ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Well we could see an initial  
? decrease in acidification. But  
we would also see less energy?  
coming from the sun to heat the  
ocean. With colder water comes  
a greater ability for the ocean  
to absorb  $\text{CO}_2$  and go through  
the acidification process  $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{H}^+$   
Ocean acidification is when  $\text{CO}_2$  and  
 $\text{H}_2\text{O}$  combine to make  $\text{HCO}_3^- + \text{H}^+$ .  
and because of the acidity of  $\text{HCO}_3^-$   
this would acidify the ocean.  
But because this process gives  
off energy, the water would warm  
and ~~step~~ slow its rate of acidification.  
But I think you would see an  
overall increase in acidification.

unclear

24

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

18

The greenhouse effect is when the sun's energy <sup>type?</sup> enters the atmosphere, is partially absorbed by the earth, partially reradiated, then the reradiation is absorbed by greenhouse gases and radiated out in all directions. These gases also ~~reflect~~ <sup>absorb</sup> much of the sun's energy before entering. <sup>which?</sup> ~~no~~.

So if more ash were in the atmosphere less energy would enter the atmosphere.

Decreasing both atmospheric and earth temperatures. But we would also see the energy that does come in stay <sup>why?</sup> trapped in the cycle longer. which could provide some relief to dropping temperatures.

Overall the effect would be to decrease temperatures

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They both involve rising gases.

They are caused by different stimuli

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

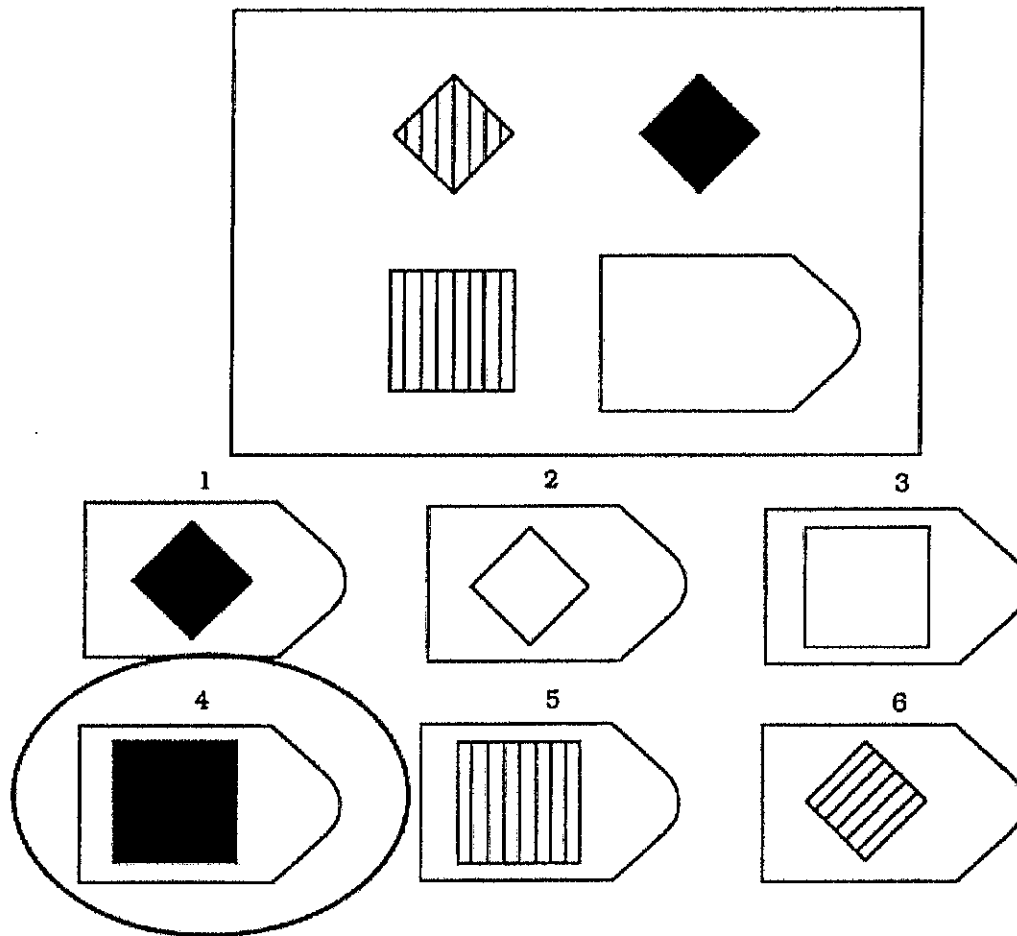
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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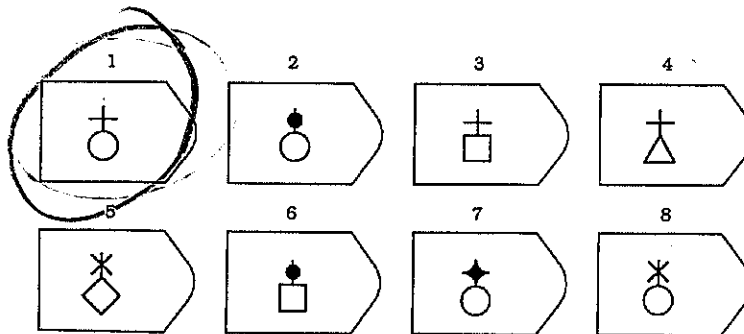
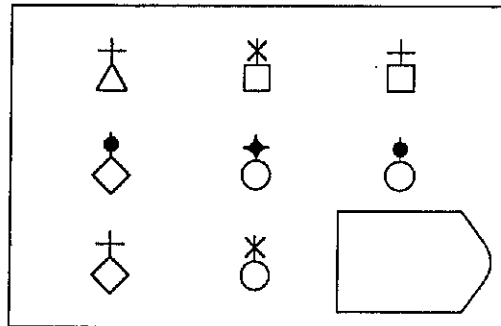


Answer: 4

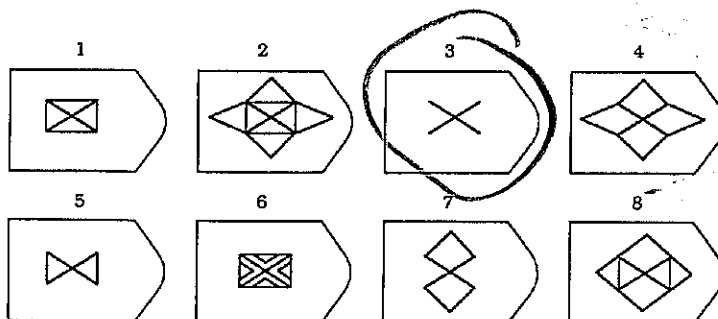
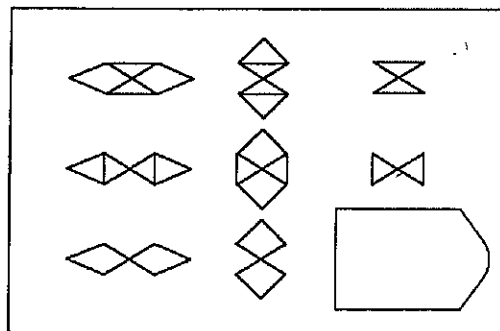
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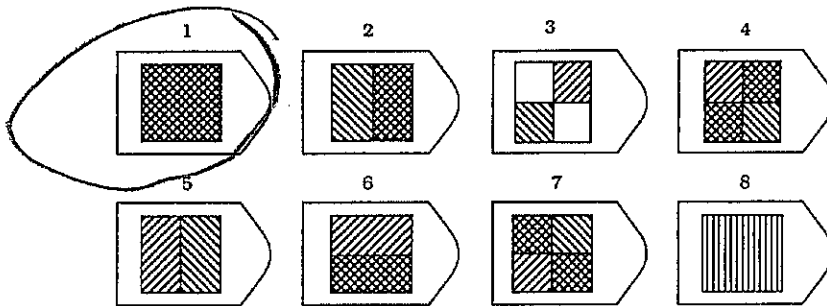
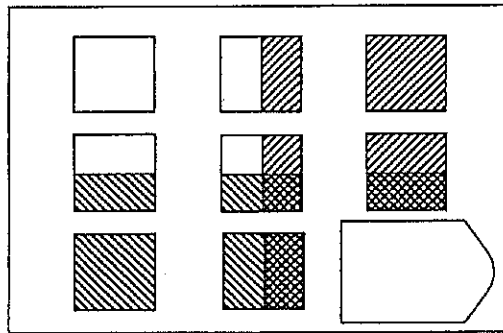
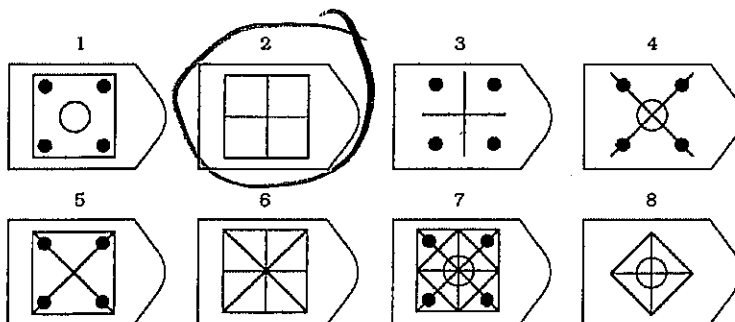
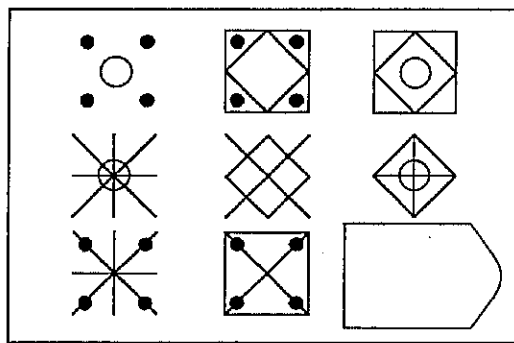
Please choose the image that best completes each of the following patterns.

### PATTERN 1



### PATTERN 2

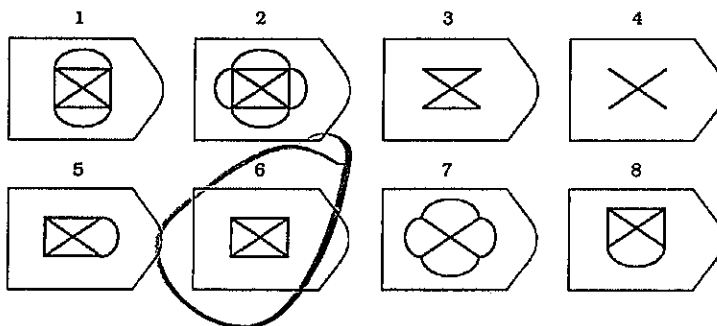
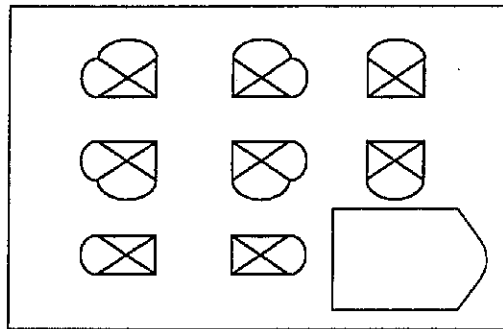


**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

A414/50 320

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

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- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
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3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

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- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
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4. The rival gangs used graffiti to define their territorial boundaries.

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PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
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Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
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2. Catching a cold is like...
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  - ☐ B. Getting pink eye. They are similar because they are both contagious.
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  - ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48843

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 40737921  
Version B

GROUP: 17

95

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
D ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. ~~The magma becoming colder~~  
B ☒ b. Gas bubbles forming in the magma  
c. ~~The surrounding crust becoming hotter~~  
d. ~~Crystals forming in the magma~~
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
C ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
C ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
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a. Human activities are the primary cause of the greenhouse effect.  
B ☒ b. Natural processes are the primary cause of the greenhouse effect.  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
B ☒ a. Reservoir A has a shorter residence time than Reservoir B.  
B ☒ b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- 1000/50*
- a. ~~The reservoir will eventually disappear.~~
  - ☒ b. The reservoir is not in equilibrium.
  - c. ~~The reservoir is growing smaller.~~
  - d. ~~The reservoir's residence time is 10 years.~~

B

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- ☒ b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

D

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. ~~Reflection of more solar radiation, causing atmospheric temperature to increase~~
- c. ~~Re-emitting of more infrared radiation, causing atmospheric temperature to increase~~
- d. ~~Re-emitting of more infrared radiation, causing atmospheric temperature to decrease~~

A

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

B

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification occurs from increase levels of  $\text{CO}_2$  in the water. When the level of  $\text{CO}_2$  in the atmosphere increases, more carbon is absorbed by the oceans, causing a rise in ocean  $\text{CO}_2$  levels. The carbon molecules form with the hydrogen molecules, creating different ions and increasing the ocean acidification.

The increase of atmospheric carbon dioxide will warm the atmosphere, in turn warming the ocean. Although the increase of atmospheric  $\text{CO}_2$  causes an increase of ocean  $\text{CO}_2$ , the molecules are not dissolved as easily in the warm water, slowing down the process. The act of higher  $\text{CO}_2$  levels in the atmosphere causing higher  $\text{CO}_2$  levels in the ocean would be positive feedback. The increased water temperature allowing less  $\text{CO}_2$  to be dissolved would be negative feedback.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25  
A sudden dramatic increase in volcanic activity causing large ash clouds to form in the atmosphere would block a large portion of the visible energy generated by the sun from reaching the Earth's surface to be absorbed. Since the visible energy is not reaching the Earth's surface so that it can be absorbed and re-emitted as infrared energy to be absorbed and re-emitted again by the greenhouse gases, the atmospheric temperature would likely decrease. Instead, most of the visible energy would be reflected back into space by the large ash clouds.

ok

both are chemical processes.

evaporation releases the GHG water vapor into the atmosphere, while degassing typically releases carbon into the atmosphere.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**



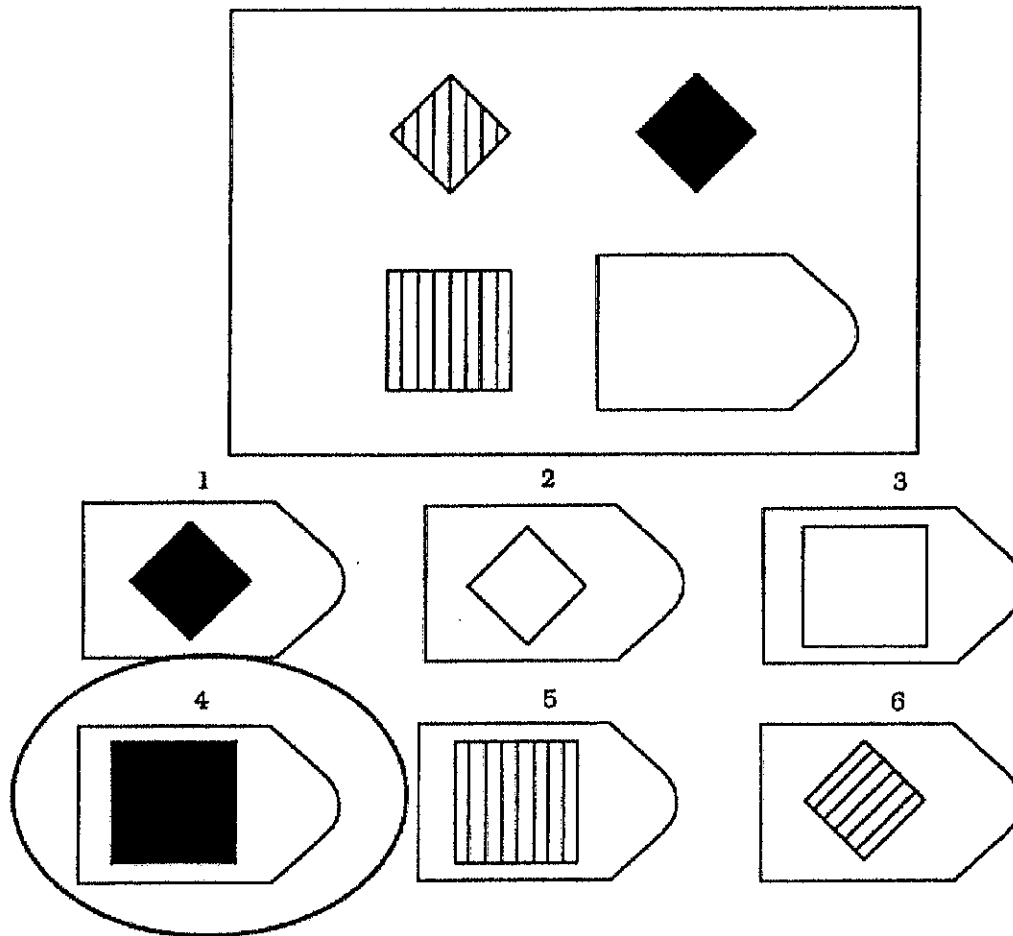


# Analogical Assessment

---

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



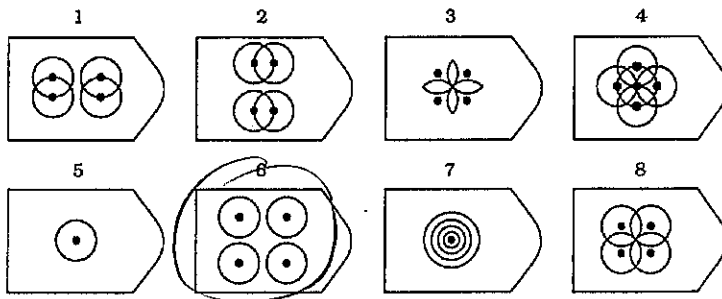
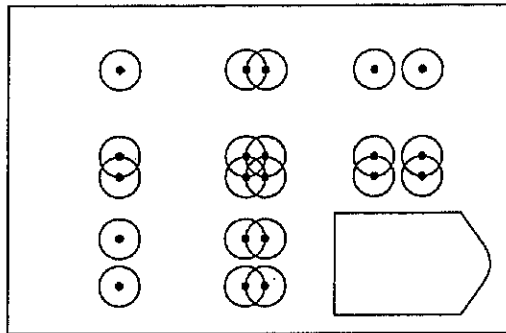
**Answer: 4**

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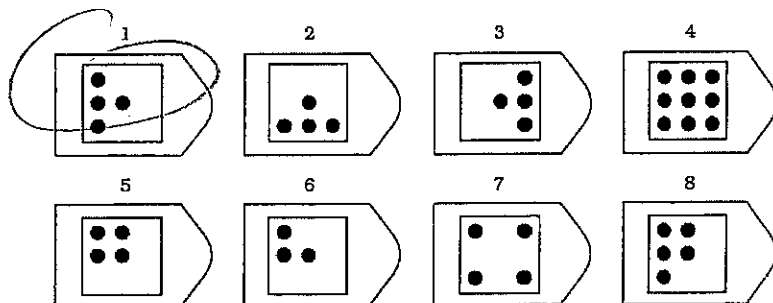
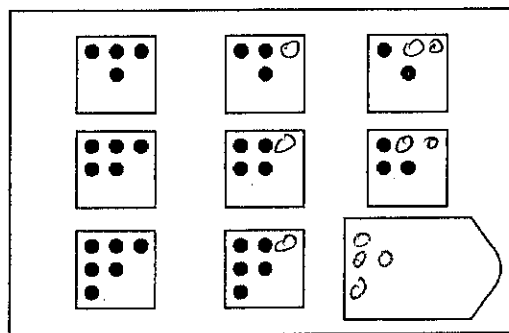
A40737921

Please choose the image that best completes each of the following patterns.

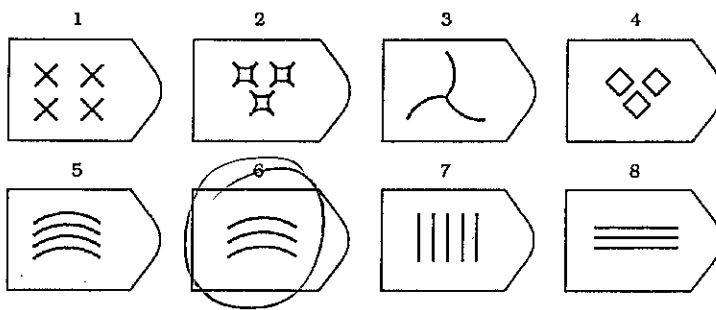
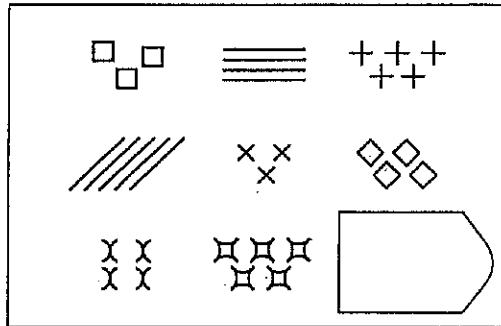
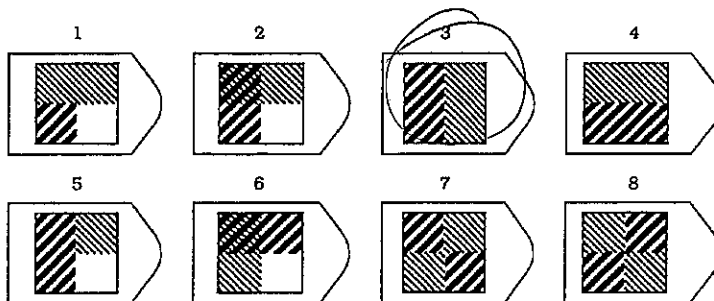
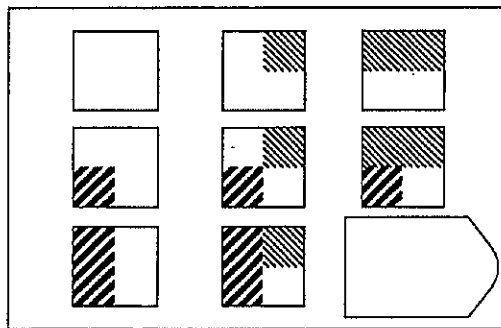
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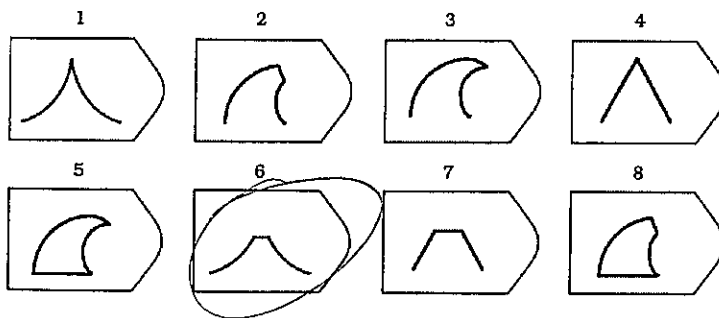
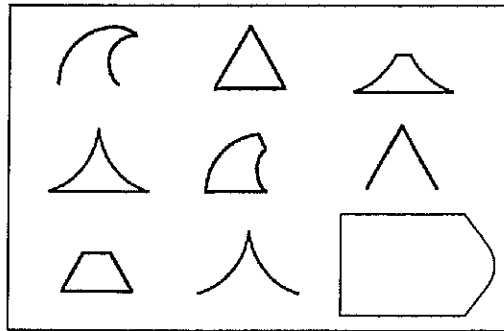


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

A40737921

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48374

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 422 35241  
Version B

GROUP: T7

77

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- C 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- B 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
- E 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☒ e. The human and natural causes of the greenhouse effect are not understood.
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- A 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- D 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- A 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- D 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

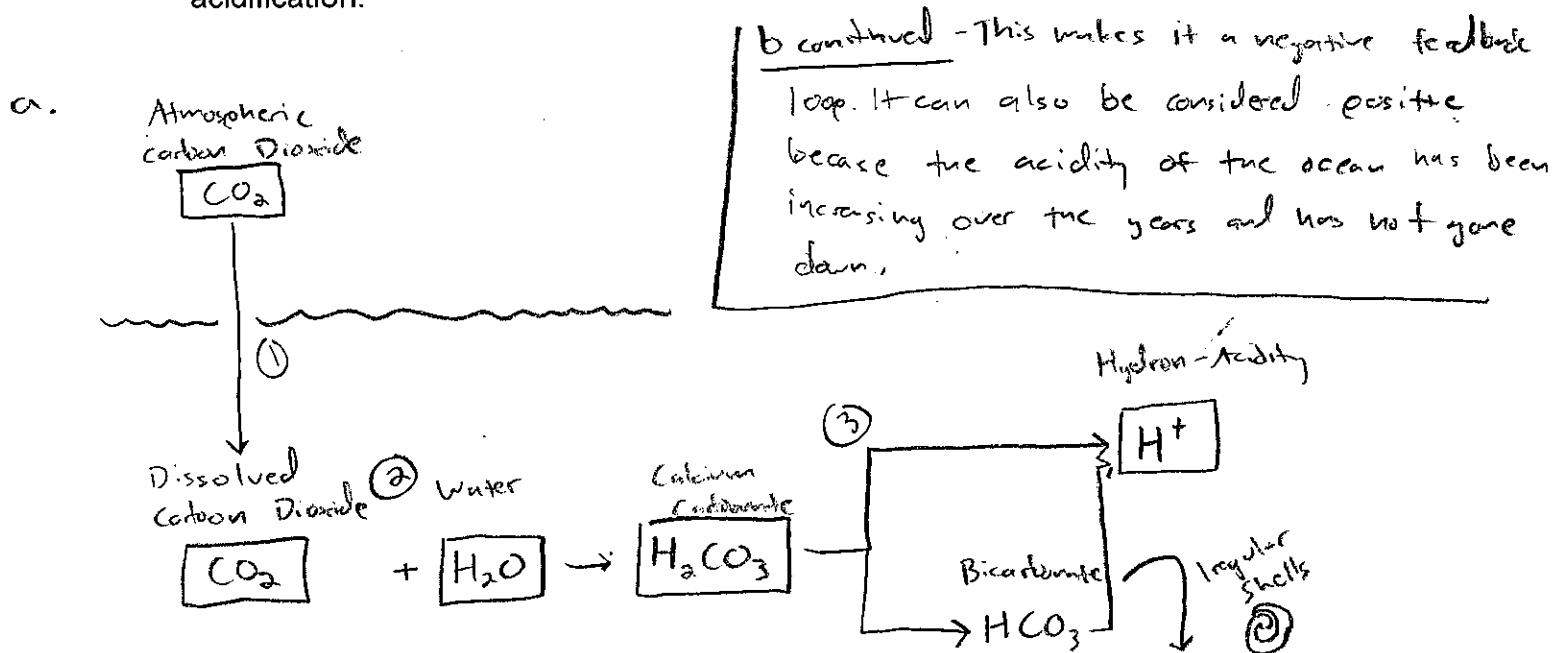


**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



①  $\text{CO}_2$  transfers from the atmosphere to the Oceans because of increased  $\text{CO}_2$  in the atmosphere, in order to reach equilibrium. It dissolves in the ocean.

② The dissolved  $\text{CO}_2$  combines with the water ( $\text{H}_2\text{O}$ ) to form Carbonic Acid ( $\text{H}_2\text{CO}_3$ ).

③ The  $\text{H}_2\text{CO}_3$  breaks up to form  $\text{HCO}_3^-$  and  $\text{H}^+$ , the  $\text{H}^+$  increases the acidity of the ocean.

b. This can be considered a negative feedback loop because increased  $\text{CO}_2$  will not only increase acidification, it will also increase temperatures in the atmosphere, which in turn increases temps in the Ocean. Increased temperatures would slow down the Ocean Acidification, therefore the system would be attempting to return to equilibrium.

25

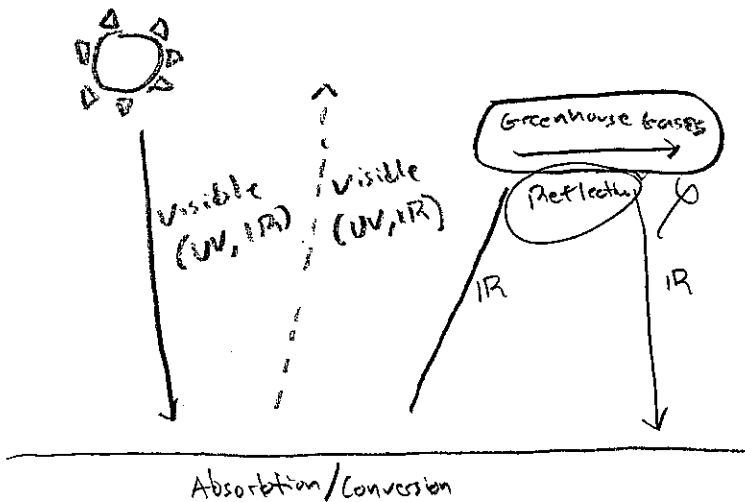
2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

22

**Greenhouse Effect:**



Volcanism would release a large ash cloud that would block the visible light (UV, IR) that normally reaches the earth for absorption and conversion. So the amount of UV and IR energy would decrease. Volcanism also releases a large amount of  $\text{CO}_2$  that would increase the greenhouse effect because  $\text{CO}_2$  is a greenhouse gas.

b. At first, we cannot tell whether atmospheric temperature would increase or decrease. It could decrease from the ash cloud allowing less UV and IR energy/light to reach the surface. But it also may decrease due to an increased greenhouse effect <sup>why?</sup> which would trap more of the energy that does reach the earth.

However, after the ash cloud is out of the atmosphere, the sudden burst of greenhouse gases (specifically  $\text{CO}_2$ ) released by the Volcanism, would cause more energy to be reflected, therefore temperature would increase.

**Extra credit (2 points).**

How are evaporation and degassing similar and/or different?

They are both the transfer of substances from the biosphere to the atmosphere. Evaporation is part of the water cycle, degassing the carbon.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

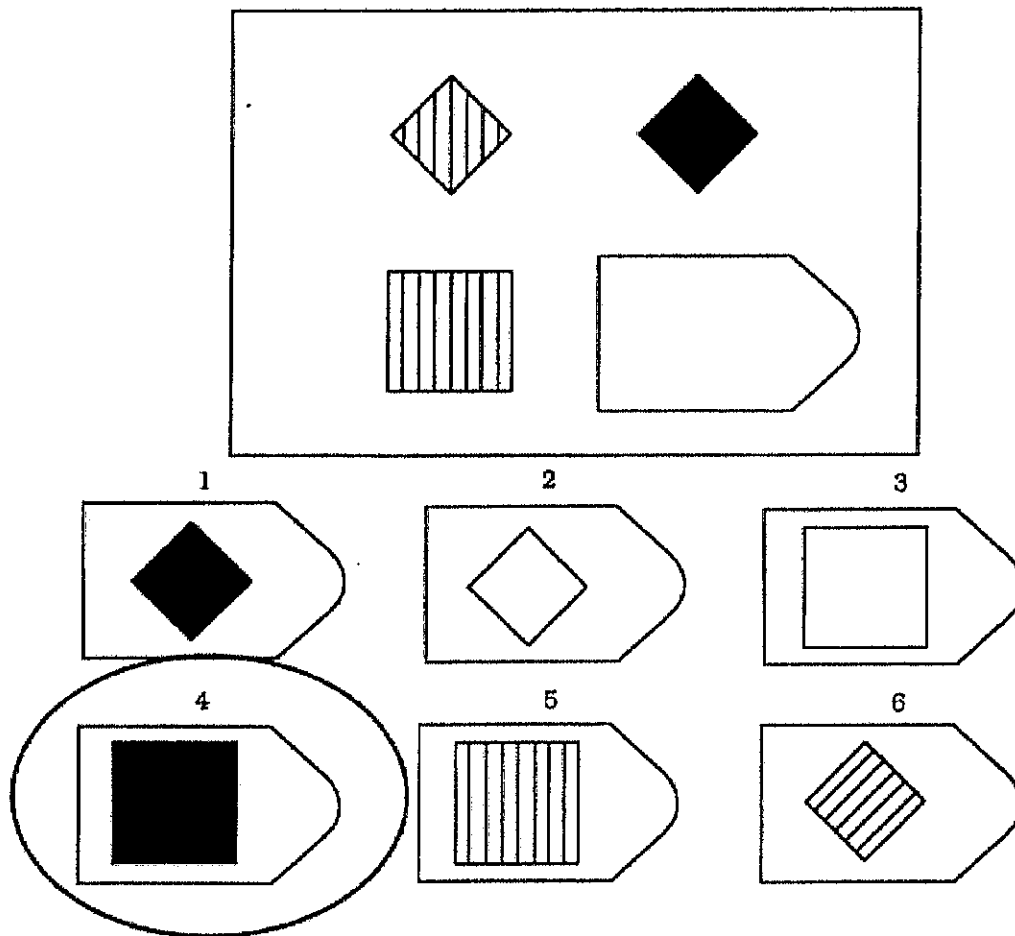
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

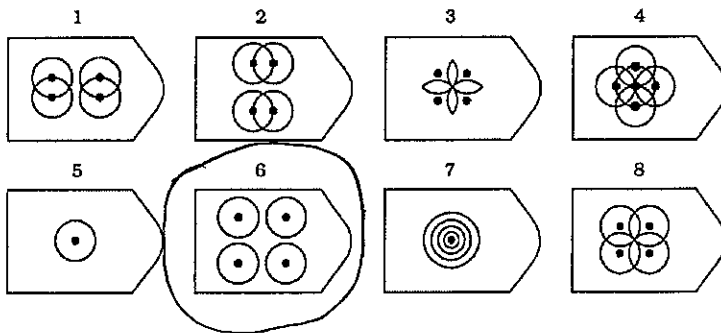
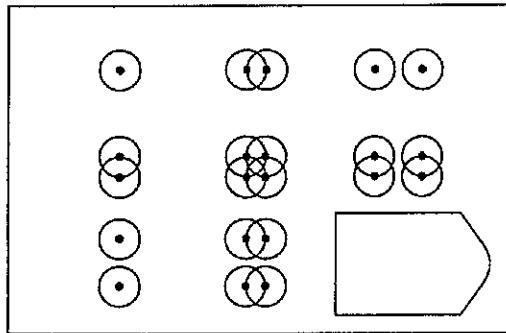


**Answer: 4**

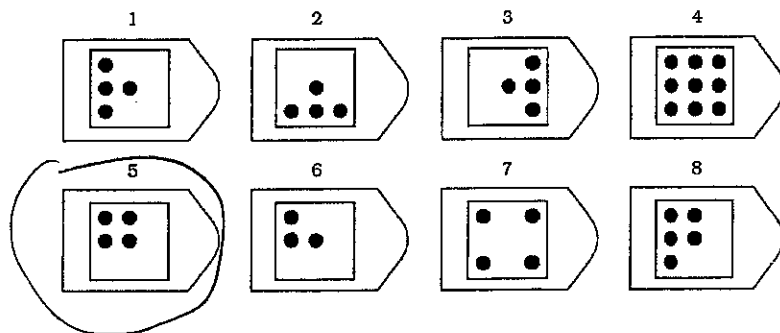
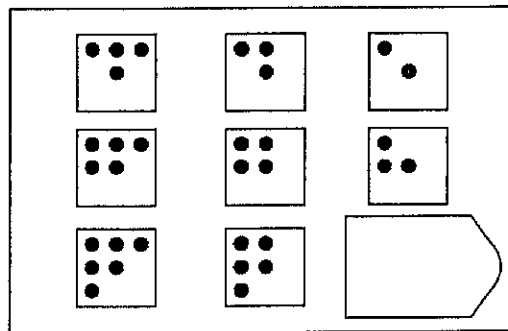
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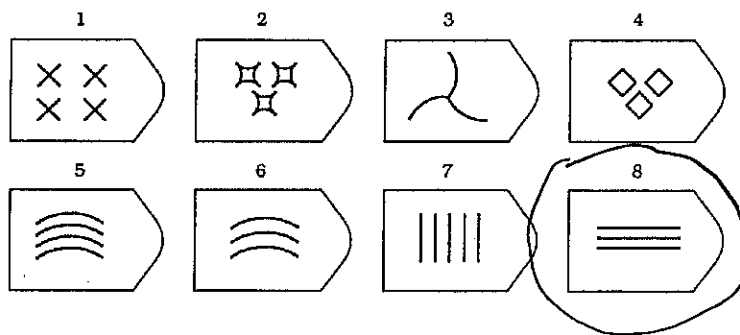
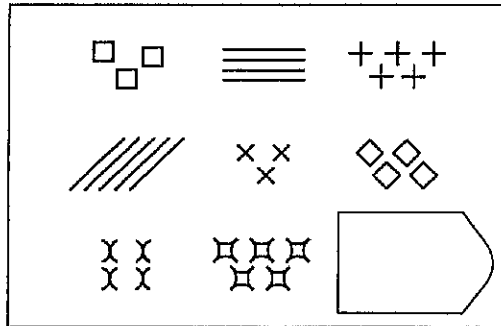
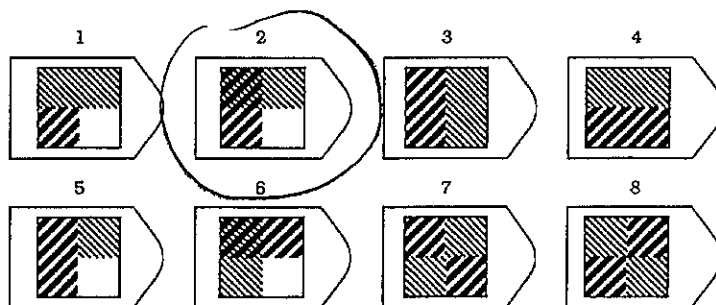
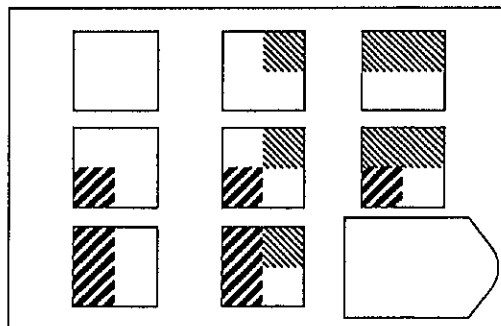
Please choose the image that best completes each of the following patterns.

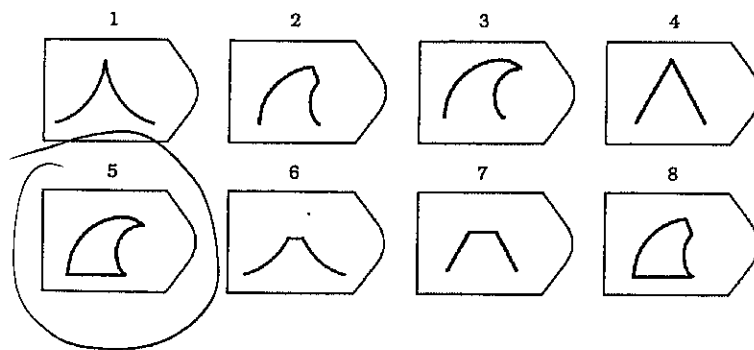
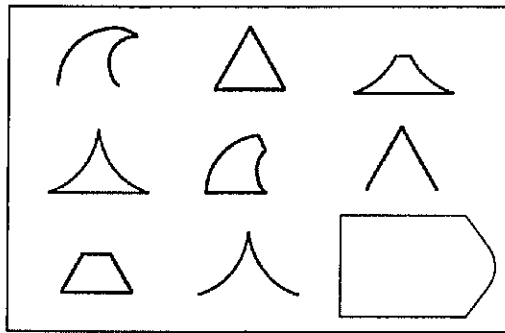
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

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A. While debugging their broken firewall, a programmer came across top-secret CIA files.

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2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

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D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE



5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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Please choose the response that is closest to an analogy that you might make.

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- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
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- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
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2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49083

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A41398990  
Version B

GROUP: T8

70

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
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2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

A ————— A  
B ————— B
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- The reservoir will eventually disappear.
  - ☒ The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
  - The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of ~~the world~~ limited human-caused greenhouse gas emissions to 1990 rates?
- The Earth's atmosphere would become colder than it is today.
  - ☒ The Earth's atmosphere would become warmer than it is today.
  - ~~The Earth's atmosphere would remain about the same temperature as it is today.~~
  - ~~The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.~~
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ Reflection of more solar radiation, causing atmospheric temperature to decrease
  - Reflection of more solar radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.~~
  - ~~More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.~~
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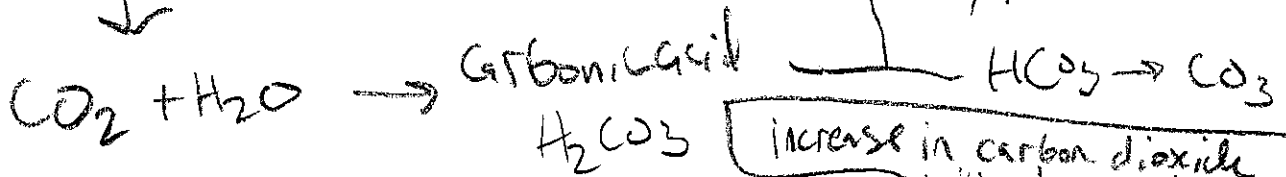
**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

$\text{CO}_2$  atmosphere



25

- $\text{CO}_2$  comes into ocean through atmosphere
- $\text{CO}_2$  mixes with water
- forming  $\text{H}_2\text{CO}_3$  carbonic acid
- which forms  $\text{H}^+$ ,  $\text{HCO}_3^-$ ,  $\text{CO}_3^{2-}$

increase in carbon dioxide will change the oceans temperatures warmer by making it colder. Because colder water can hold more  $\text{CO}_2$

as the 4 steps goes down the ocean gets more acidic. Colder water holds more  $\text{CO}_2$  quickening the process

Positive Feed Back loop

- More  $\text{CO}_2$  from LRS → increasing the residence time of  $\text{CO}_2$  in carbon cycle.
- More  $\text{CO}_2$  goes into atmosphere
- From atmosphere  $\text{CO}_2$  goes into ocean
- More carbon dioxide in ocean with a longer residence time forces a change in equilibrium and offsets recovery to get back to equilibrium.

Negative feedback loop

- Because of global warming the world temperatures are increasing the warmer temperatures slow the ocean acidification process down. (including the ocean temp)
- Because the ocean holds less  $\text{CO}_2$  forcing the ocean back in equilibrium

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

OK  
25

Green house expindia

- Sun emits radiation waves
- The earth receives Visible radiation waves (short)
- These waves are short wived and can go through the earth's atmosphere
- ~~the~~ short waves hit earth's surface and are absorbed in the surface
- The surface that absorbed the shortwave radiation starts radiating long waves back into the atmosphere
- Greenhouse gases such as  $CH_4/CO_2/H_2O/H_2O$  — prevent long wave radiation going through by absorbing these waves
- when absorbed it starts generating heat back to the earth surface and space

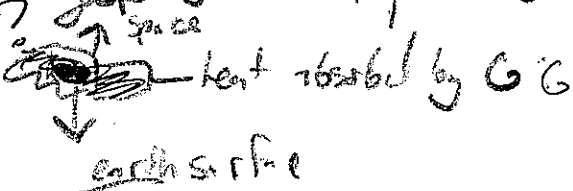
Volcanism and atmospheric temp

When large amounts of volcanism occurs it will lower the sky in ash

ash will prevent sunlight from entering the atmosphere

The world becomes colder because the sunlight can not enter through the atmosphere

The heat that is trapped by green houses gases will impact the world less because it is escaping in the space



when ash disappears the world will continue  $CO_2$  in atmosphere

Since ash is gone, sunlight can enter the atmosphere and the sun light will go through the green house explanation and become trapped in the atmosphere warming the earth.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

$CO_2$  Ocean → degasse → atmosphere but its composition is  $H_2O$  rather than  $CO_2$

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

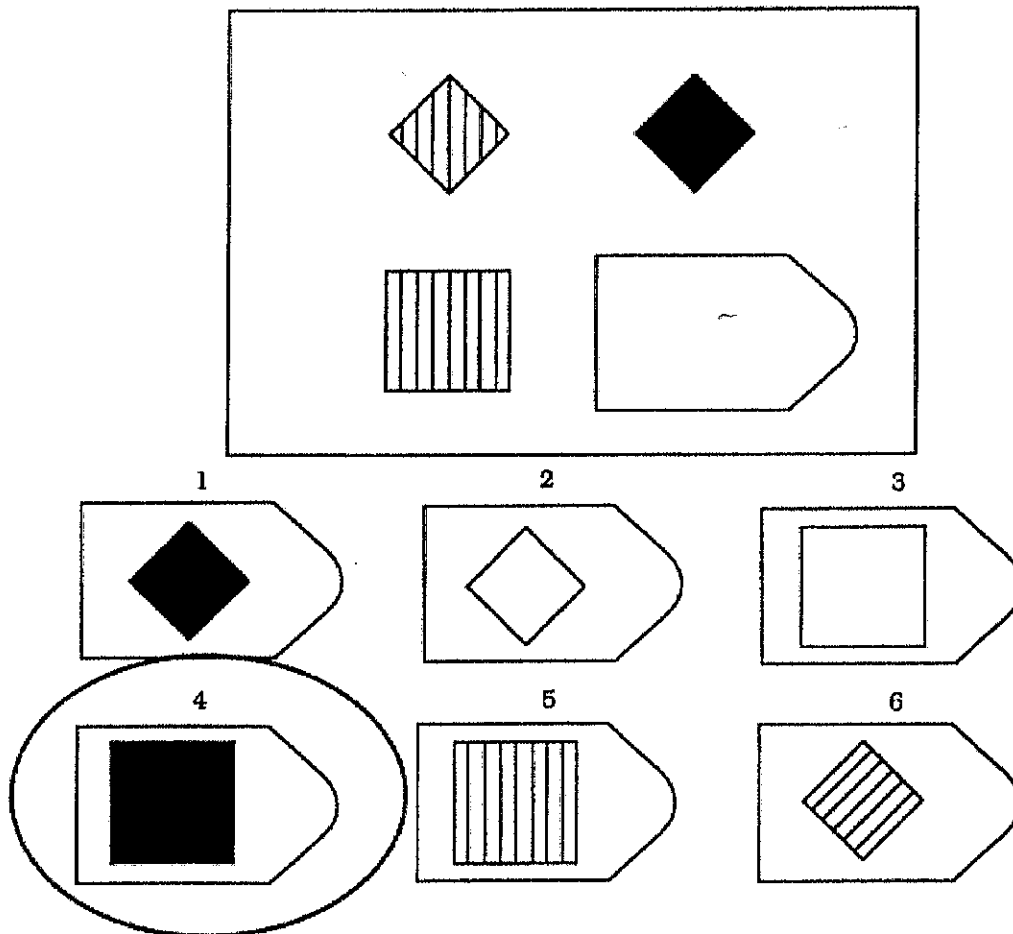




# Analogical Assessment

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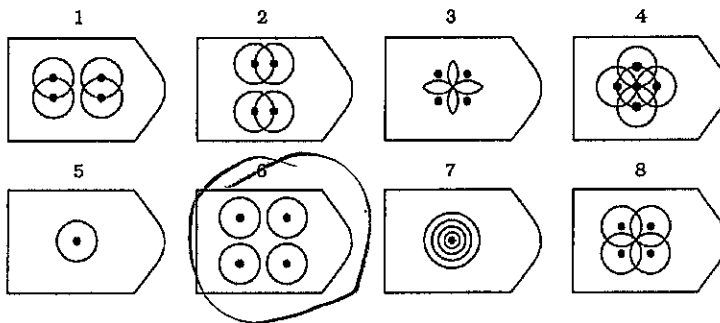
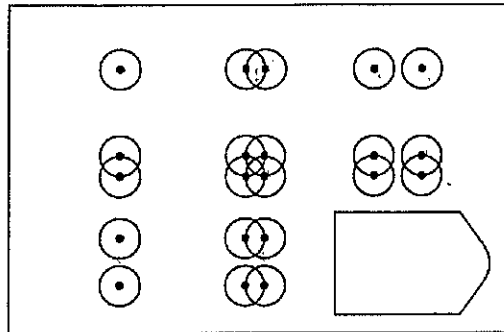


**Answer: 4**

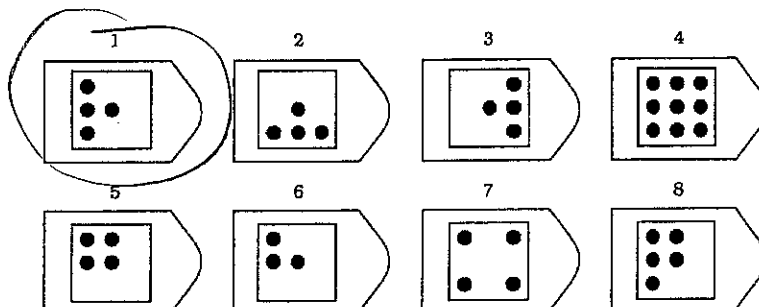
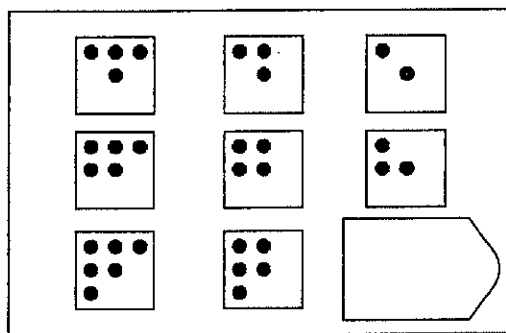
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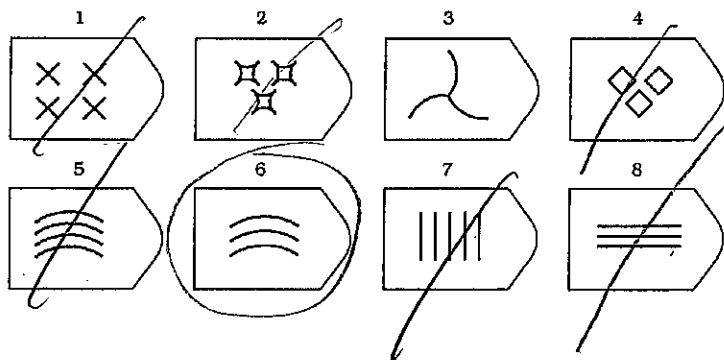
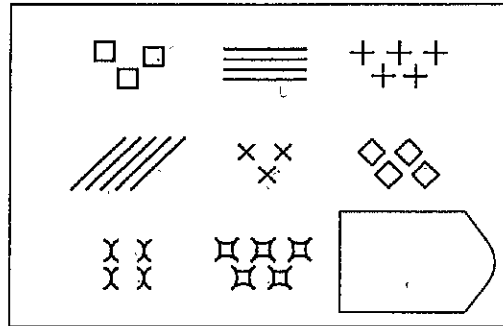
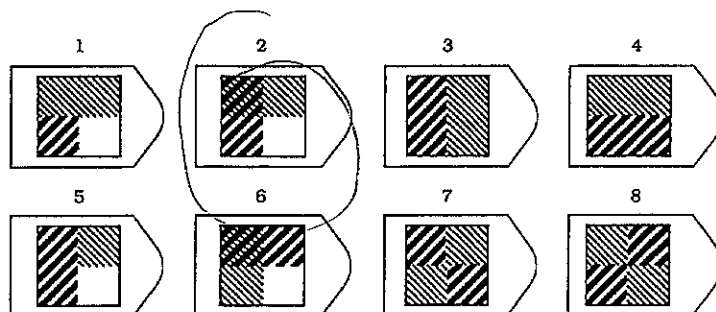
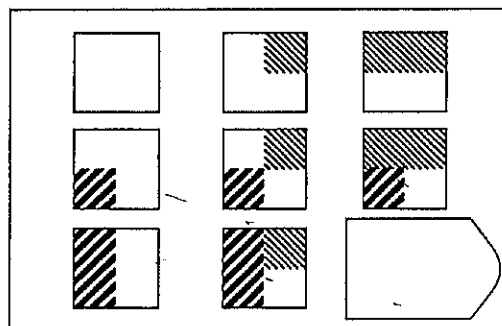
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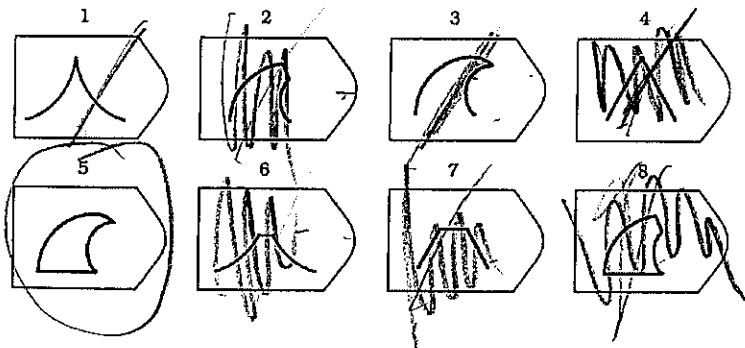
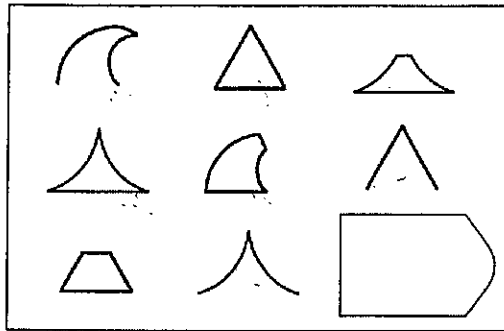


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

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- ~~C.~~ Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
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- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- ~~A.~~ After eating a big lunch, Dan went back to his office and took a nap.
- ~~B.~~ When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.

B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.

☒ C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.

D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

---

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

☒ A. Getting high. They are both involve too much of a chemical influencing the body.

~~B. Hitting your head. They both involve something that causes headaches.~~

C. Being sleep deprived. They both involve impaired functions.

~~D. Eating too much candy. They both involve lack of self-control.~~

E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

A. Dew forming. They are similar because they both involve a drop in temperature.

B. Blowing up a balloon. They are similar because they both involve becoming less dense.

☒ C. Clouds forming. They are similar because they both involve a phase change.

D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 4767

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

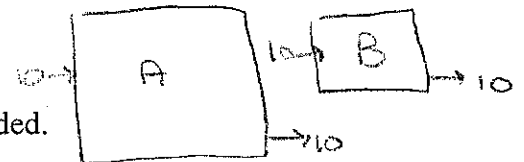
STUDENT NAME: A40659708  
Version B

GROUP: T7

90

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed ~~X~~ increase +  
b. Melting of permafrost resulting in more methane escaping into the atmosphere ~~X~~ increase +  
c. An increase in evaporation and cloud formation resulting in the release of latent heat ~~X~~ increase + increase  
D d. An increase in desert formation resulting in more dusting blowing into the atmosphere increase + increase
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder ~~X~~ more dense = slowing  
B b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter ~~X~~ closer densities = slowing  
d. Crystals forming in the magma ~~X~~ more dense = slowing
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A=erosion; B= deposition, C= uplift and erosion  
b. A =erosion; B= biochemical precipitation, C= uplift and deposition  
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d. A = dissolution, B= deposition, C=uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
C c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. Reservoir A has a shorter residence time than Reservoir B.  
B b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.



cold water holds  
CO<sub>2</sub> better

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear. ✗
- b. The reservoir is not in equilibrium. ✓
- c. The reservoir is growing smaller. ✗
- d. The reservoir's residence time is 10 years.



growing larger = not in equilibrium

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A a. The Earth's atmosphere would become colder than it is today. ✗
- b. The Earth's atmosphere would become warmer than it is today. ✓
- c. The Earth's atmosphere would remain about the same temperature as it is today. ✗
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same. ✗

Not sure what today's emission rates are, but if it is above 1990 then the answer is A.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A a. Reflection of more solar radiation, causing atmospheric temperature to decrease ✓
- b. Reflection of more solar radiation, causing atmospheric temperature to increase ✗
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase ✗
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease ✗

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature. ✗
- B b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature. ✓
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature. ✗
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Increasing + increasing = positive



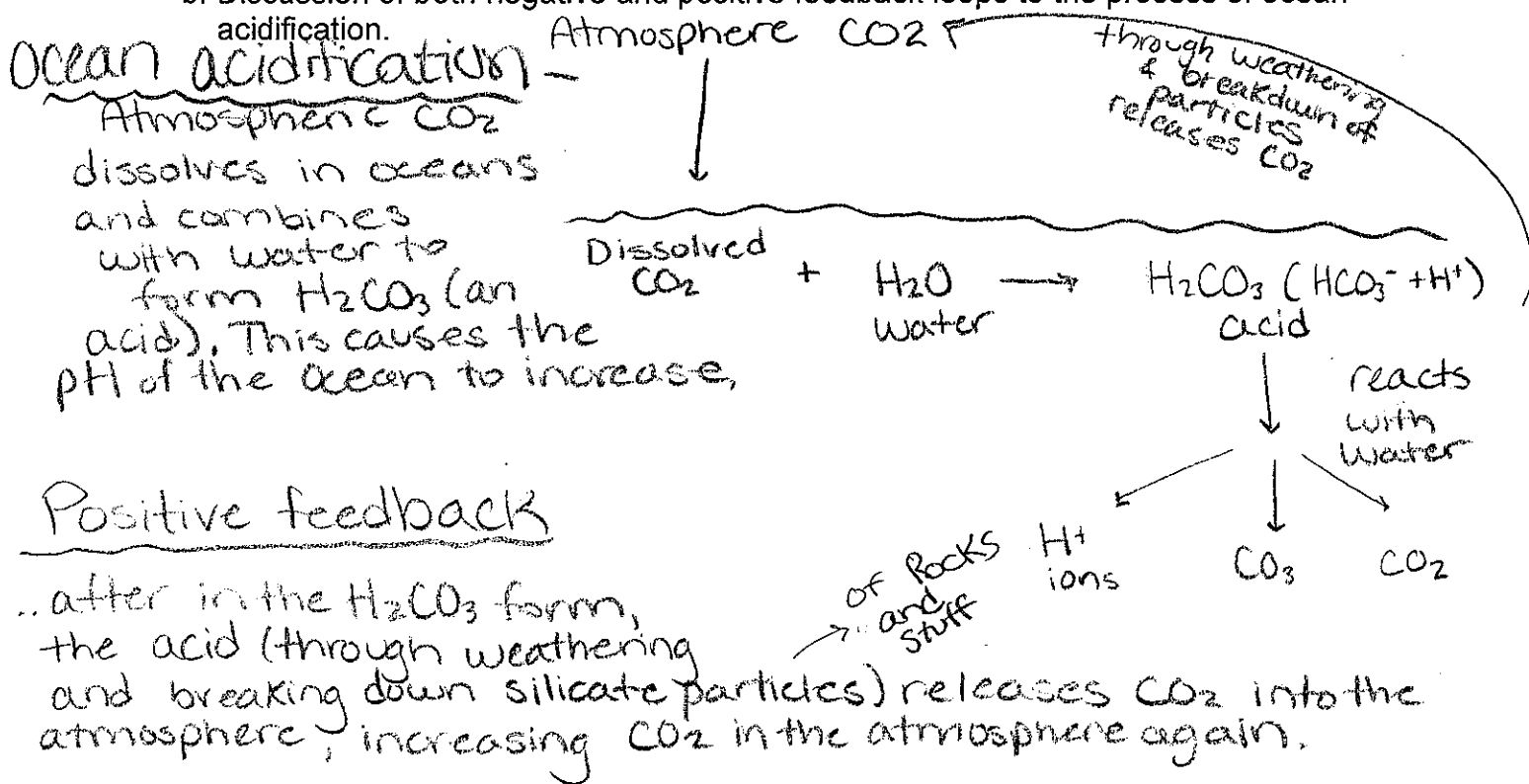
SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

25

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



Negative feedback

~~With more  $\text{CO}_2$  going into the oceans, there is a decrease in  $\text{CO}_2$  in the atmosphere which causes a decrease in temperature. The cooling of ocean waters leads to an increase in ocean acidification because cold water ~~absorbs~~ absorbs  $\text{CO}_2$  better than~~

With an increase in atmospheric  $\text{CO}_2$  there is also an increase in temperature due to the greenhouse effect. The temp increase causes ocean waters to warm, but warm water doesn't absorb  $\text{CO}_2$  as well as cold water so there is a decrease in ocean acidification which helps put this system back into equilibrium.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

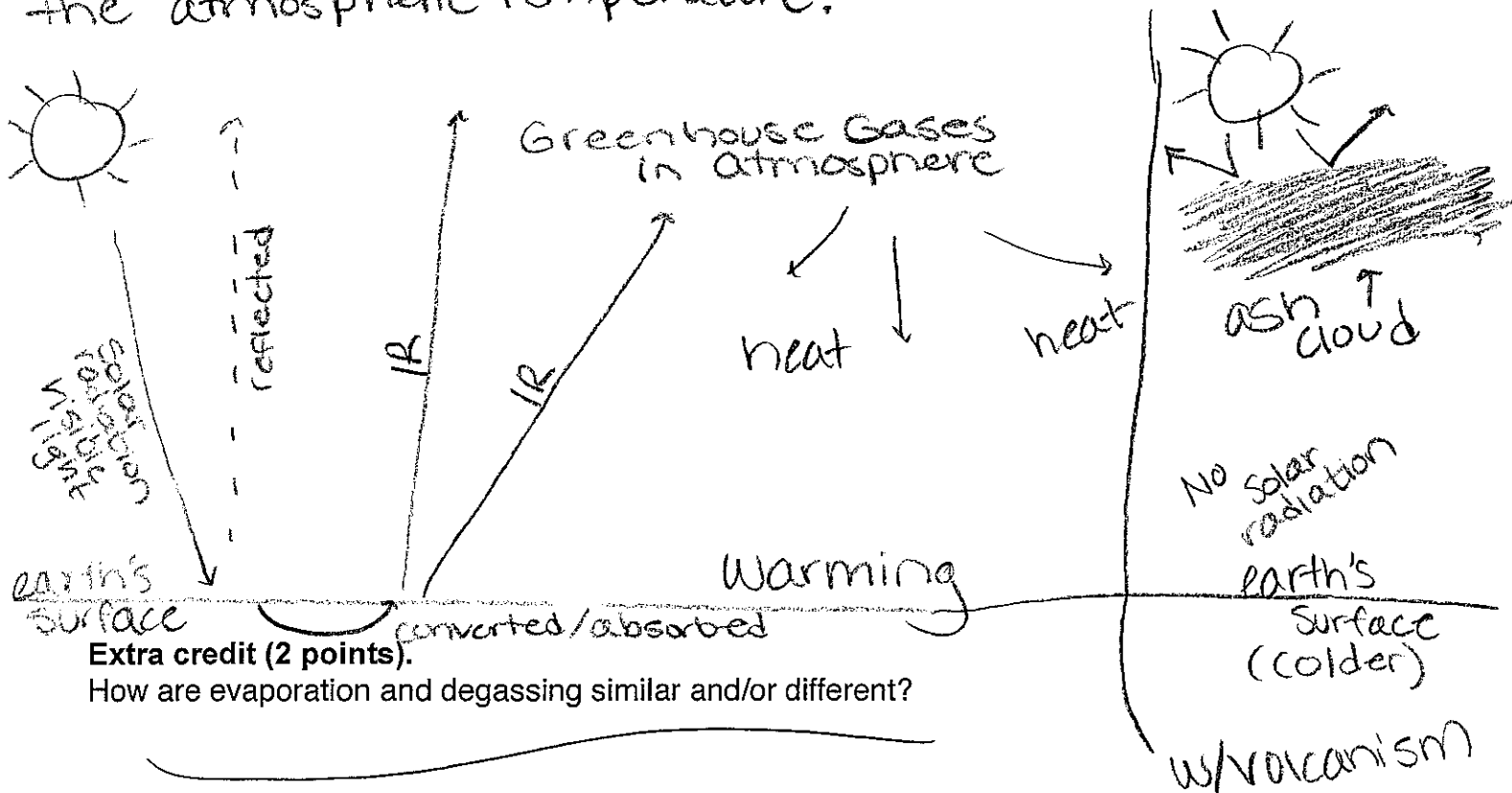
Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25

The greenhouse effect is when the sun radiates solar energy in the form of visible light. The visible light hits earth because greenhouse gases do not absorb visible light and it is able to pass freely to earth's surface. Once it hits earth it is either immediately reflected back into space (due to glacial ice cover, etc.) or it is absorbed and converted into IR thermal energy that is then re-emitted back into space or mostly into the atmosphere where it is absorbed by greenhouse gasses. The gasses send the IR heat in all directions including back toward earth where it creates a warming effect.

Volcanism sends large ash clouds into the atmosphere, which create a barrier and block incoming solar radiation from the sun. Since the radiation is not able to reach earth's surface to be absorbed and converted to heat, there would be a decrease in the atmospheric temperature.



Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

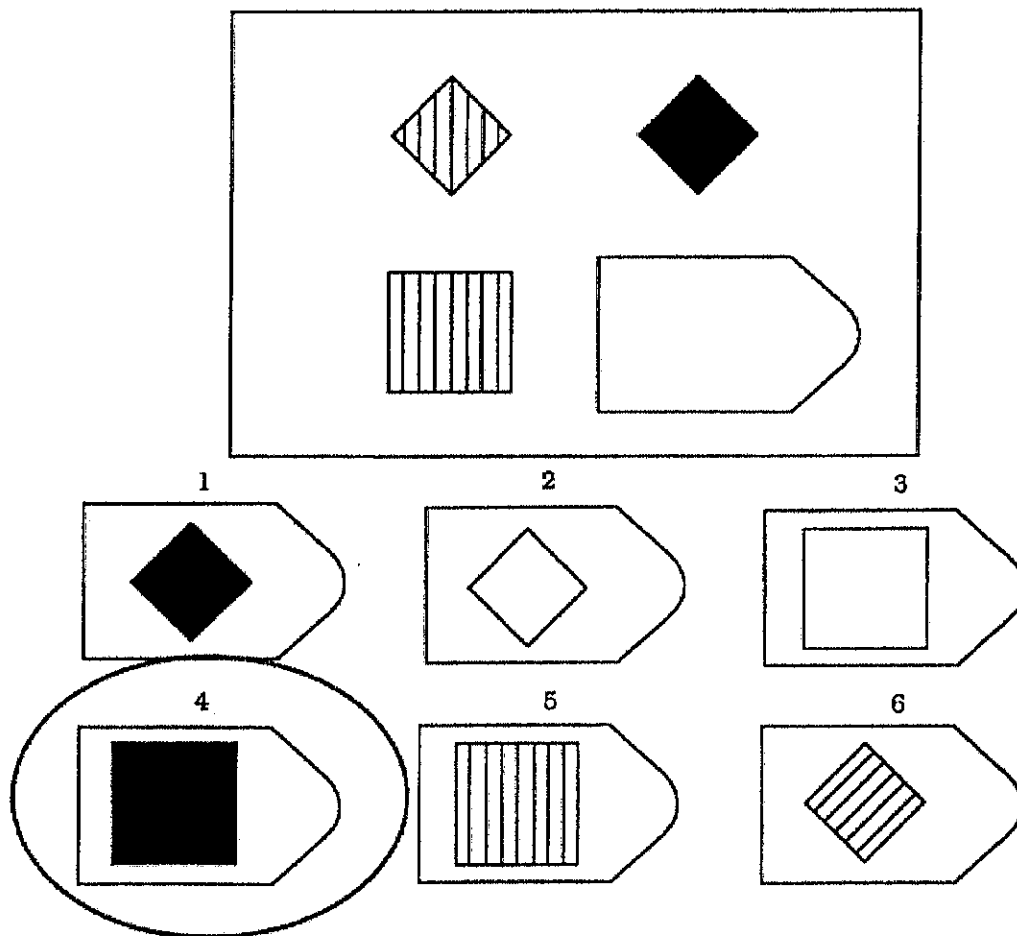
**Thoughtfully complete the attached survey**



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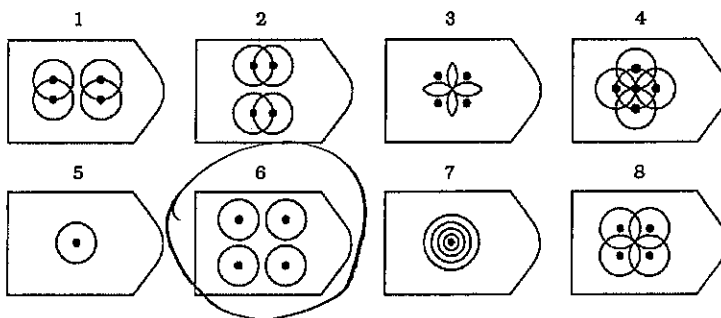
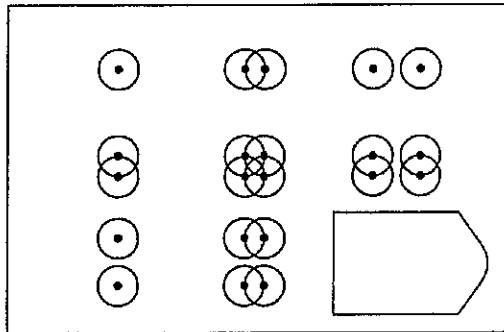


**Answer: 4**

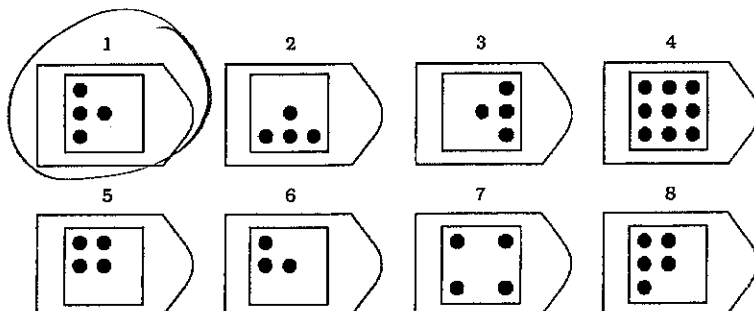
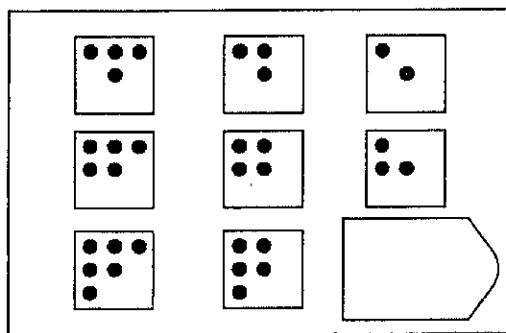
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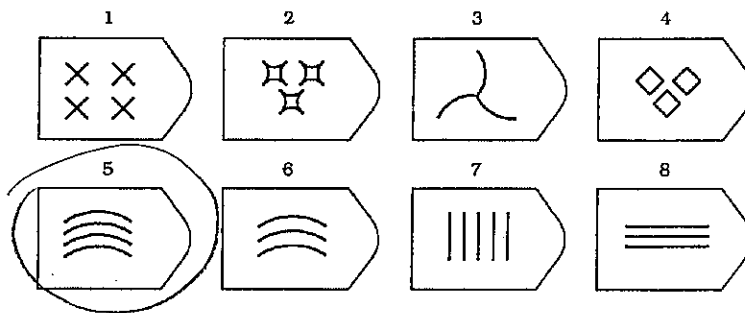
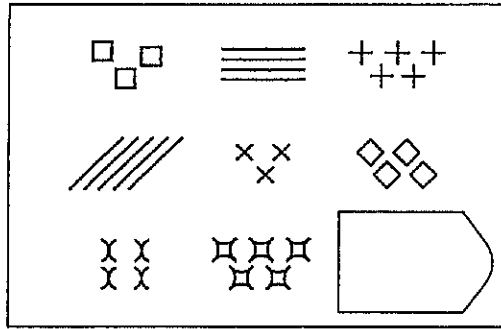
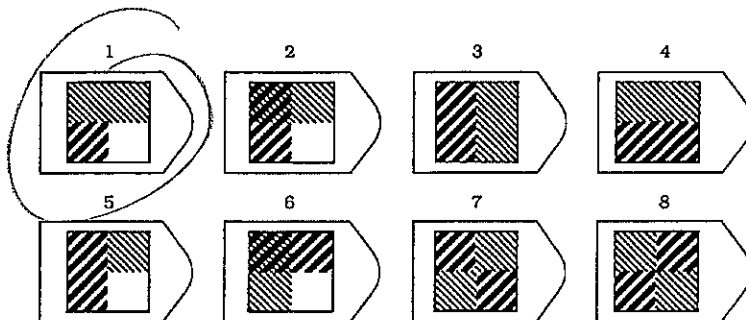
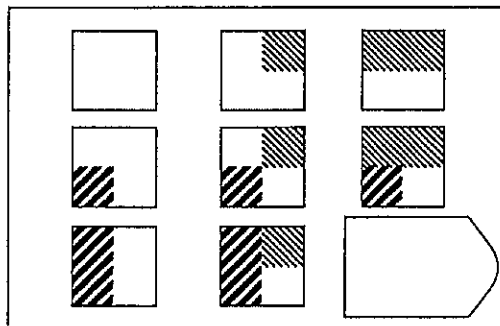
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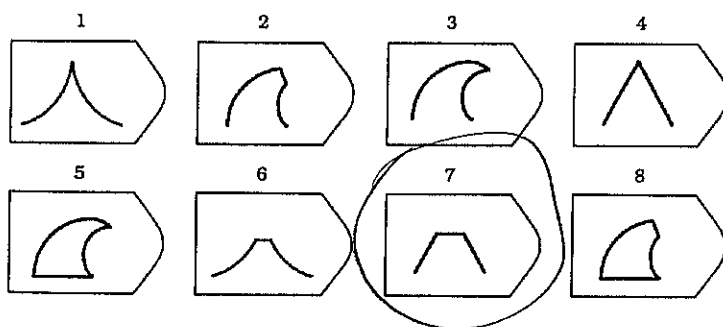
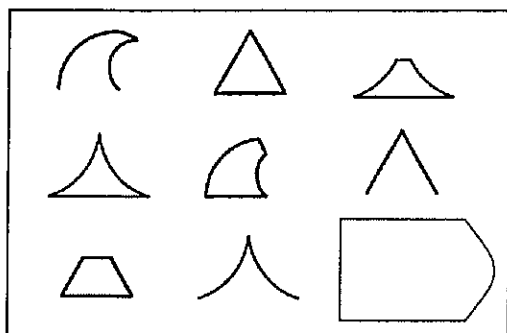
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

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PLEASE CONTINUE ON NEXT PAGE



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- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- ☒ D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 40348

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

1

84

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

**STUDENT NAME:** A45139440  
Version A

**GROUP:** T8

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- B** 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☒ a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - ☒ c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma
- D** 2. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- A** 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of   A  . Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of   B   and compaction, and then limestone becomes exposed at Earth's surface through the processes of   C  .
- ☒ a. A = erosion, B = deposition, C = uplift and erosion
  - ☒ b. A = erosion, B = biochemical precipitation, C = uplift and deposition
  - ☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - ☒ d. A = dissolution, B = deposition, C = uplift and deposition
- B** 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ☒ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☒ e. The human and natural causes of the greenhouse effect are not understood.
- C** 5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- B** 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
  - ☒ d. More information about Reservoir A and Reservoir B is needed.

B

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?

~~a.~~ The reservoir will eventually disappear.  
☒ b. The reservoir is not in equilibrium.  
~~c.~~ The reservoir is growing smaller.  
d. The reservoir's residence time is 10 years.

$$\frac{1000 \text{ km}^3}{50 \text{ km/yr}}$$

A

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
b. Reflection of more solar radiation, causing atmospheric temperature to increase  
~~c.~~ Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
~~d.~~ Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

B

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
~~c.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

A

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

☒ a. The Earth's atmosphere would become colder than it is today.  
b. The Earth's atmosphere would become warmer than it is today.  
~~c.~~ The Earth's atmosphere would remain about the same temperature as it is today.  
d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

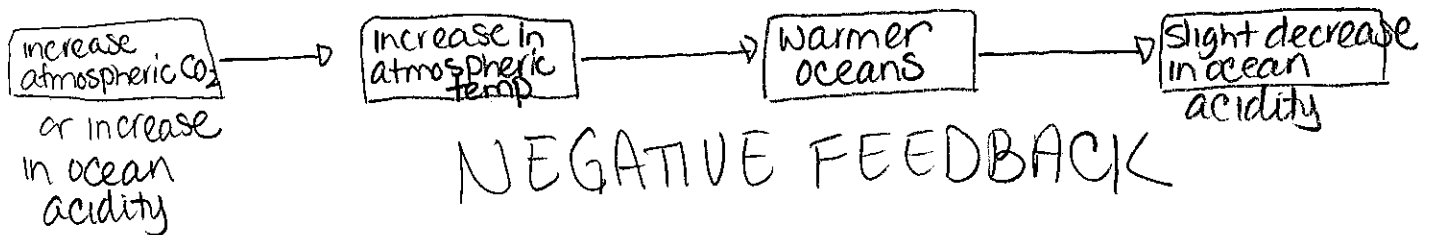
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

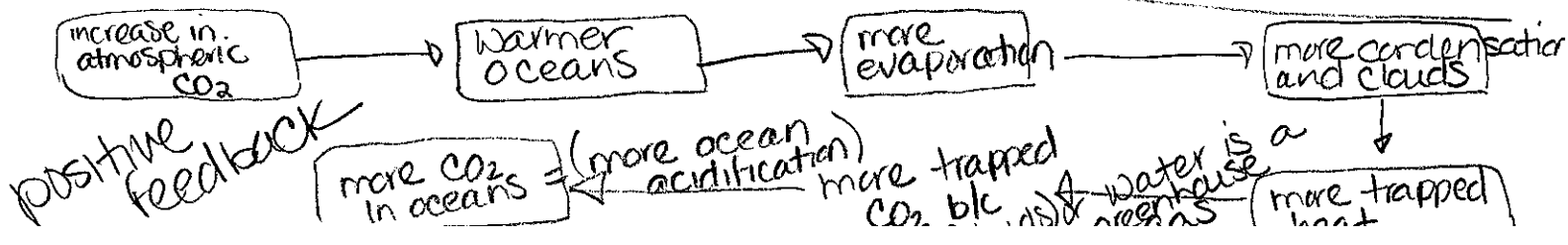
- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

An increase in atmospheric  $\text{CO}_2$  would mean that the oceans would absorb more  $\text{CO}_2$  as well. It would also mean that atmospheric temperature would increase, — as  $\text{CO}_2$  is a greenhouse gas and traps infrared heat. More oceanic  $\text{CO}_2$  would increase acidity. However, warmer  $\text{H}_2\text{O}$  absorbs less  $\text{CO}_2$  than colder  $\text{H}_2\text{O}$ , this is because warmer  $\text{H}_2\text{O}$  has molecules that move faster — these faster moving molecules make it more difficult for  $\text{CO}_2^{(\text{gas})}$  to dissolve into  $\text{H}_2\text{O}$  — they "bump" into the  $\text{CO}_2$  molecules more often and the  $\text{CO}_2$  is more likely to stay in the atmosphere.



explanation of ocean acidification: carbon dioxide, when combined w/  $\text{H}_2\text{O}$ , creates carbonic acid ( $\text{HCO}_3^-$ ) and hydrogen ions ( $\text{H}^+$ ) — which is what makes the ocean more acidic. Hydrogen ions "break up" other molecules, so to speak.



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.  
b. Clear connections between events and changes in atmospheric temperature.

22

The most important aspect of the ash clouds is that they block sunlight from reaching Earth's surface for long periods of time depending on the size of the eruption. Less sunlight would mean a decrease in atmospheric temperature. However, volcanic ash may have  $\text{CO}_2$  or methane — which are greenhouse gases and trap heat. And the ash can provide substance for water molecules to attach to, increasing atmospheric water vapor (the other greenhouse gas). — all of which would lead to more heat being trapped, increasing the temperature of the greenhouse effect. The greenhouse effect is when you have greenhouse gases ( $\text{CO}_2$ , methane or water vapor) in the atmosphere. These gases absorb and reradiate Earth's infrared heat, only to be absorbed and re-emitted by Earth again.  
from?

84

Extra credit (2 points).

- 2 How are evaporation and degassing similar and/or different? Degassing is gas leaving a liquid such as  $\text{CO}_2$  leaving the oceans. Evaporation is water or a liquid becoming a gas — they are similar because both are leaving a liquid — or breaking the bond — different because one is a gas

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

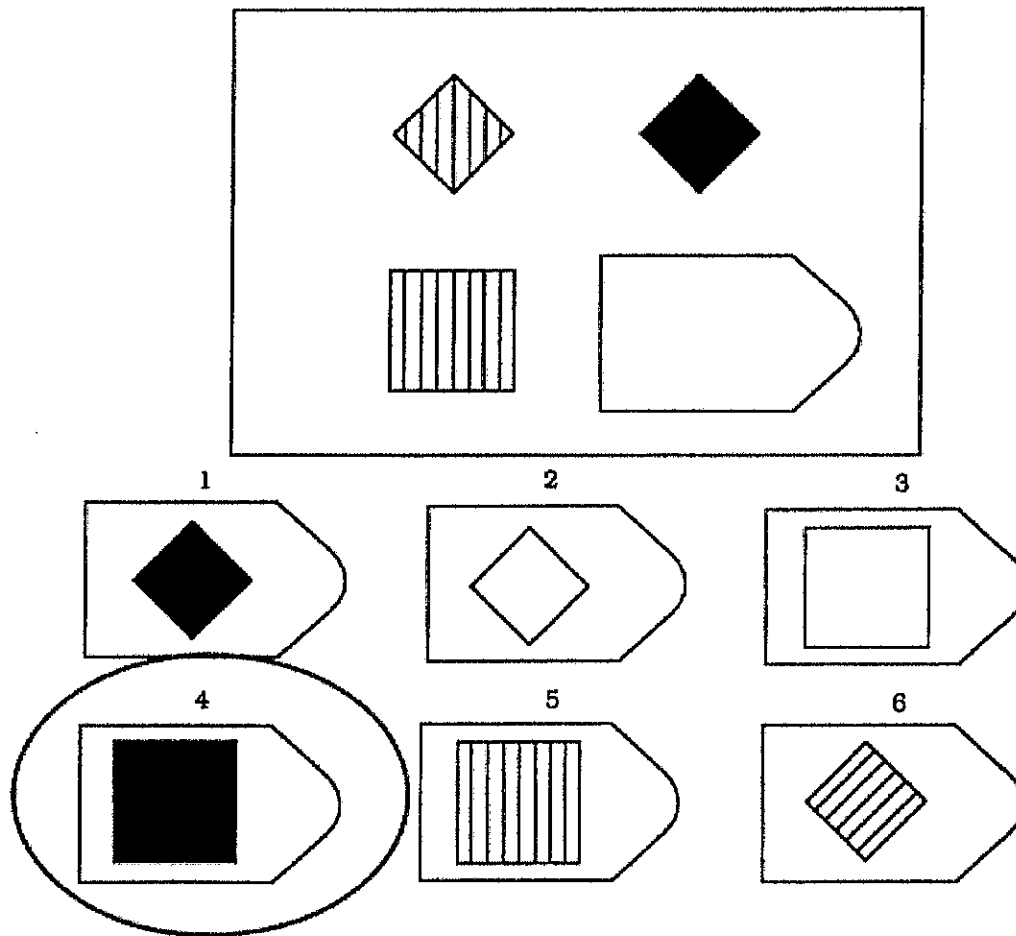




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

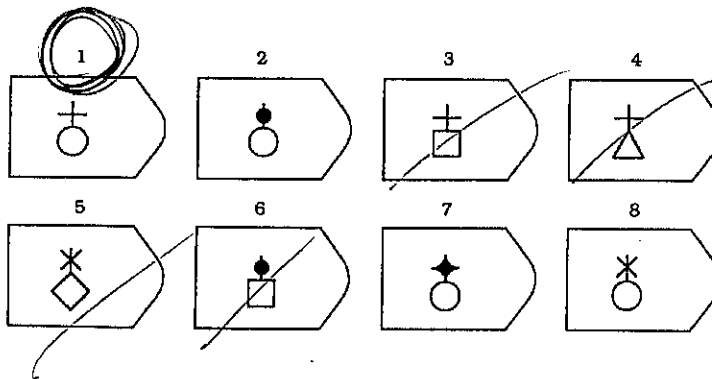
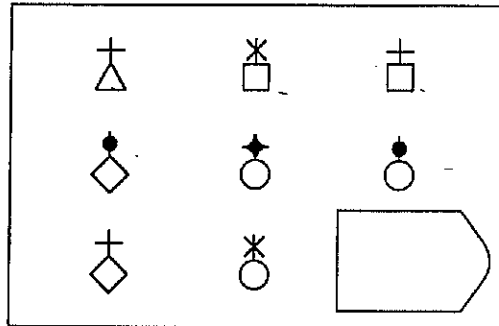


**Answer: 4**

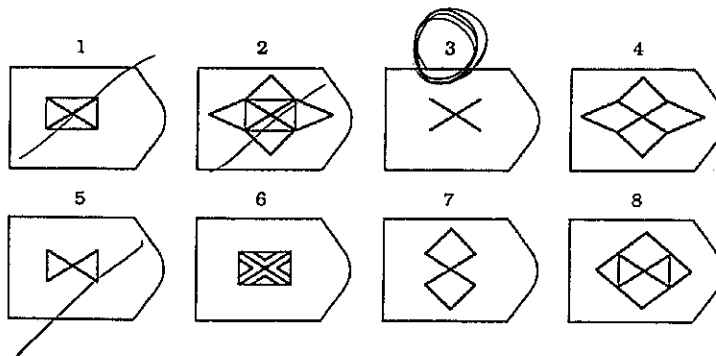
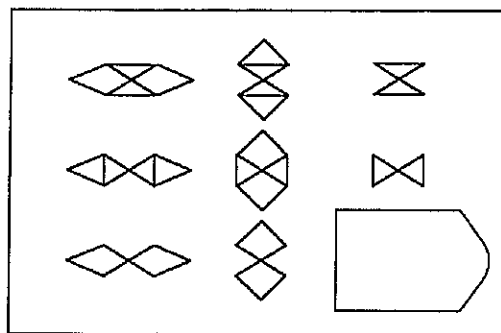
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

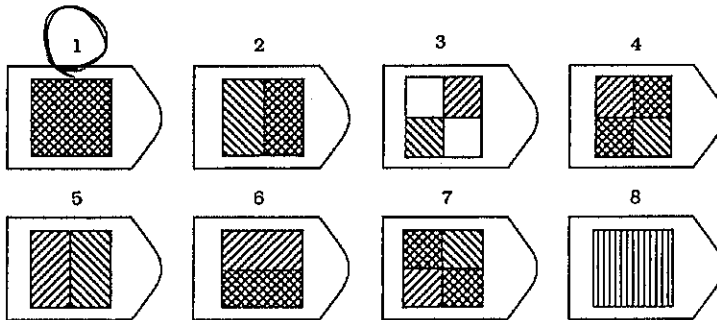
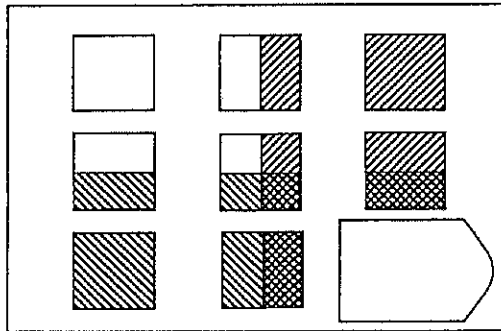



### PATTERN 2

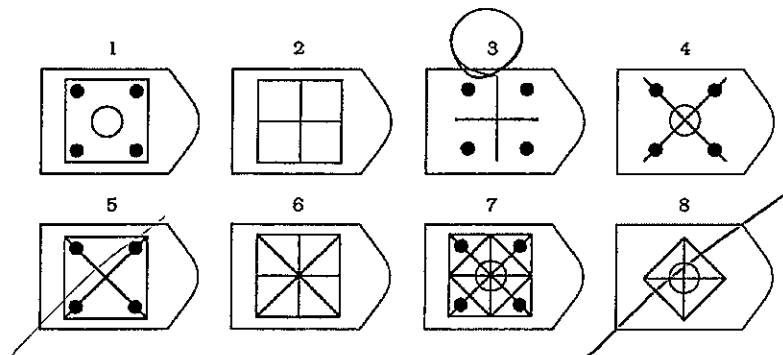
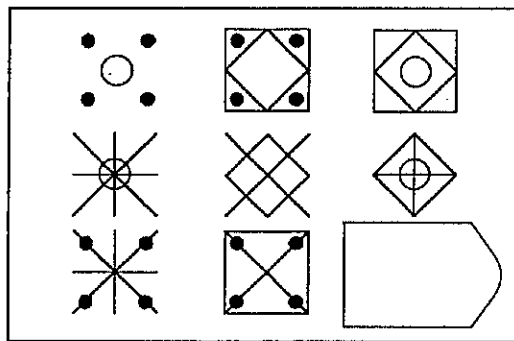


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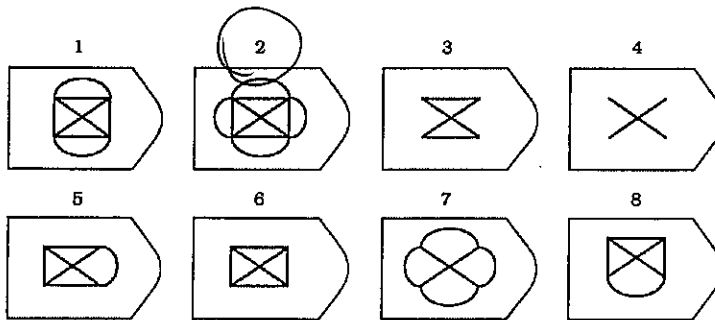
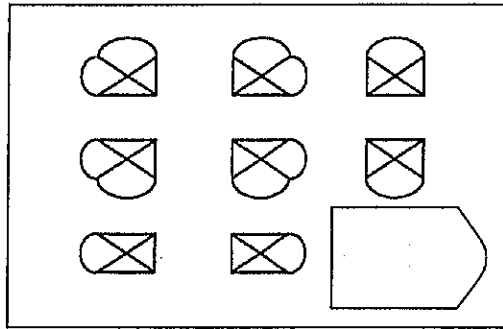
## PATTERN 3

add 

## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

A45139440

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- ☒ A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- ☒ D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- ☒ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

A45139440

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- ☒ B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 25 years

What is your home zip code? 48912

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☒ Other - Asian!

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

60

STUDENT NAME: A40861547  
Version A

GROUP: T8

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- B 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - ☒ d. Crystals forming in the magma decrease
- D 2. Which of the following would be considered a negative feedback to increasing global temperature?
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed positive
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat positive
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- A 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- C 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☒ e. The human and natural causes of the greenhouse effect are not understood.
- A 5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- A 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- ☒ a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - ☒ d. More information about Reservoir A and Reservoir B is needed.

~~D~~ 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- ~~a.~~ The reservoir will eventually disappear.
- ~~b.~~ The reservoir is not in equilibrium.
- ~~c.~~ The reservoir is growing smaller.
- ☒ d. The reservoir's residence time is 10 years.

$$\frac{1000}{100 - 50} = 10 \text{ yrs.}$$

A 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

B 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

A 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☒ a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- ~~d.~~ The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



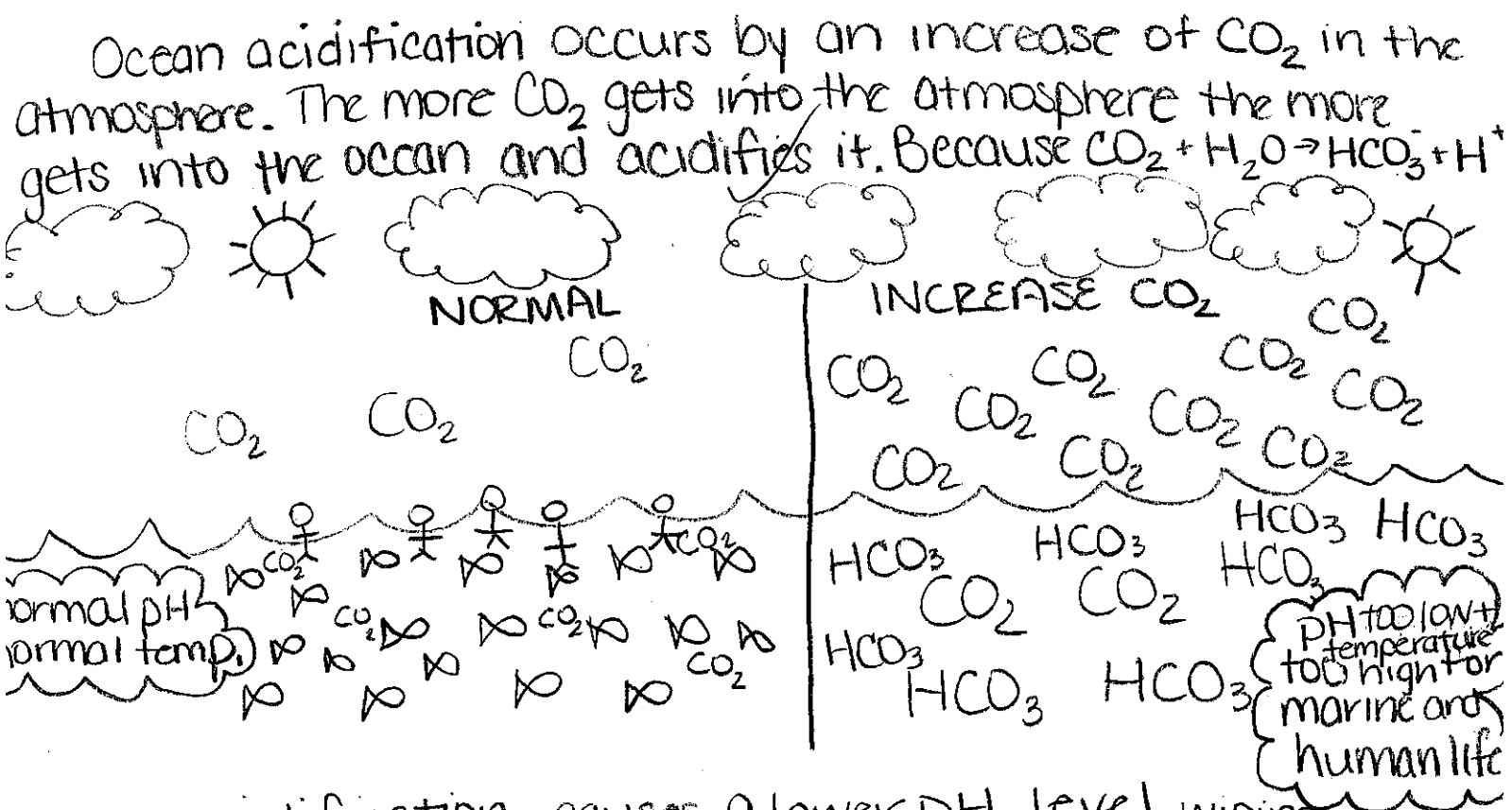
**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

/5



Ocean acidification causes a lower pH level wiping out marine life because it will be too toxic for them in addition to the rise in temperature of the water associated with ocean acidification. Increase in  $\text{CO}_2$  in the atmosphere also means an increase in water evaporation due to solar radiation and greenhouse gases which means lower water levels in oceans. On the other hand, too little  $\text{CO}_2$  in the atmosphere would also affect ocean acidification because there would be a decrease in marine life (from too high water temps and too basic pH) which means decrease in their emissions causing ocean equilibrium.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

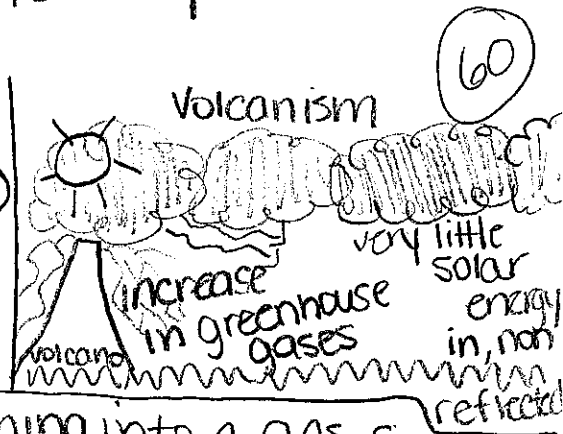
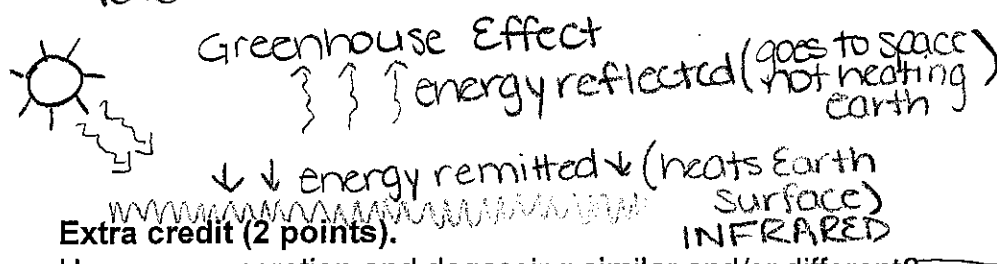
Your answer should include:

- a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- b. Clear connections between events and changes in atmospheric temperature.

20 almost

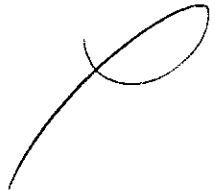
Greenhouse effect is the absorption of the sun's <sup>X</sup> heat rays. The sun beams down and the greenhouse gases (ex. CO<sub>2</sub>) take the <sub>2</sub> sun's rays and either they get re-emitted by the Earth's surface to heat it, or they get reflected back into the Earth's atmosphere and sent to space which does not heat the atmosphere. The solar energy from the sun's rays that are absorbed by the Earth's surface are called infrared because most of the energy given off by the sun is mostly visible light. + ?

Volcanism that erupts large ash clouds increase the amount of CO<sub>2</sub> and other "greenhouse gases" causing an increase in the greenhouse effect. The clouds will prevent the solar energy from getting through, causing Earth's temperatures to drop. However, the smaller amount of solar energy that does get through, it will all be re-emitted into Earth's surface. If there is enough energy that can get through and the effect of volcanism on greenhouse effect will not matter, because Earth's temperatures will level out.



How are evaporation and degassing similar and/or different?  
evaporation is the process of a liquid turning into a gas, similarly degassing is gas coming out of a liquid so they are both liquids that turn into gases however, in evaporation all continuous

Extra credit(cont.) - Of the water gets changed into a gas at one time, whereas degassing a small amount at a time (and not always the whole amount) is changed into a gas.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

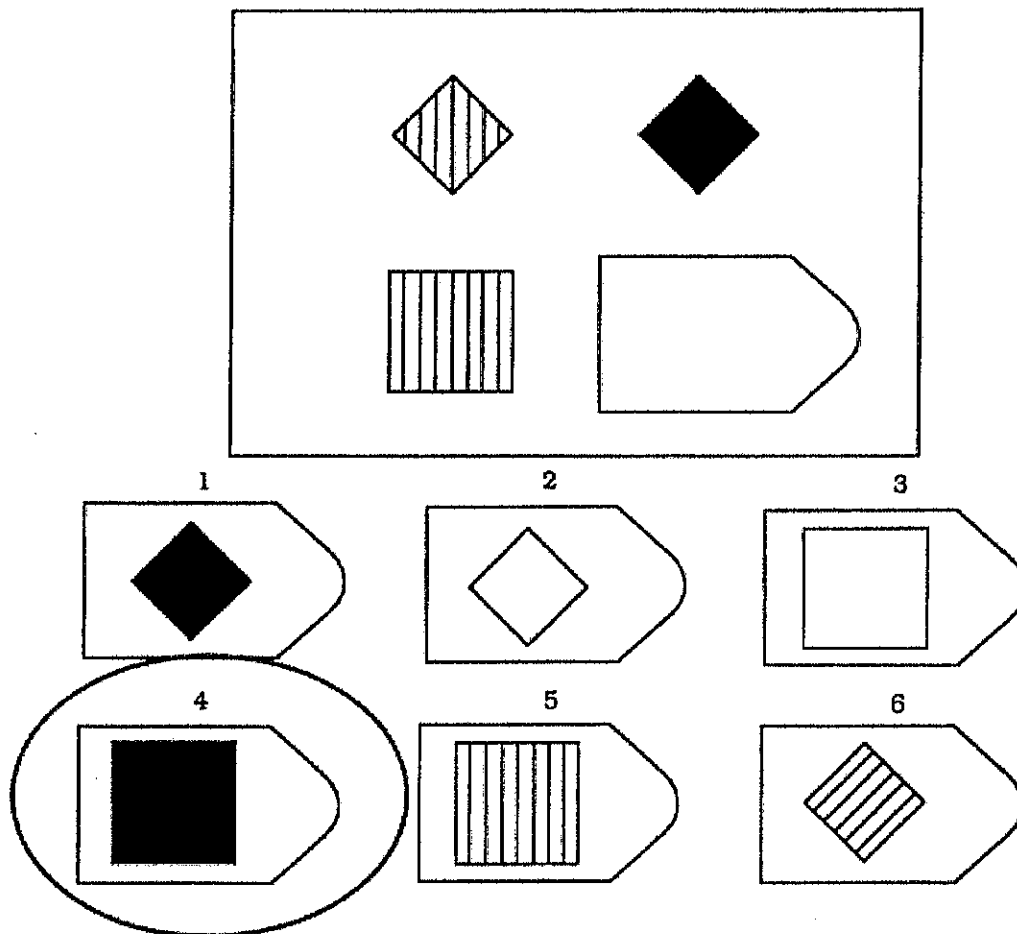
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

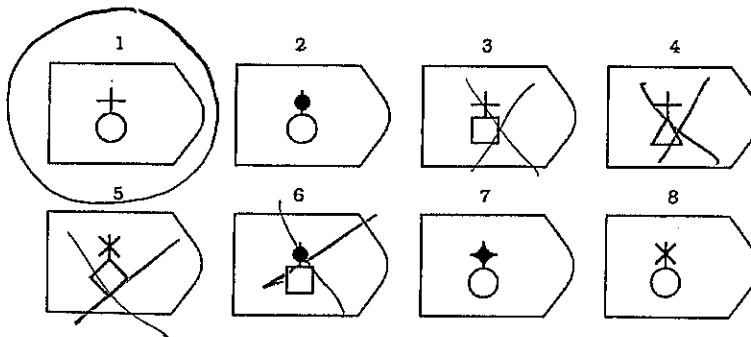
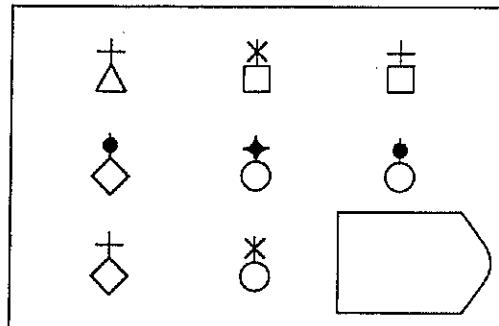


**Answer: 4**

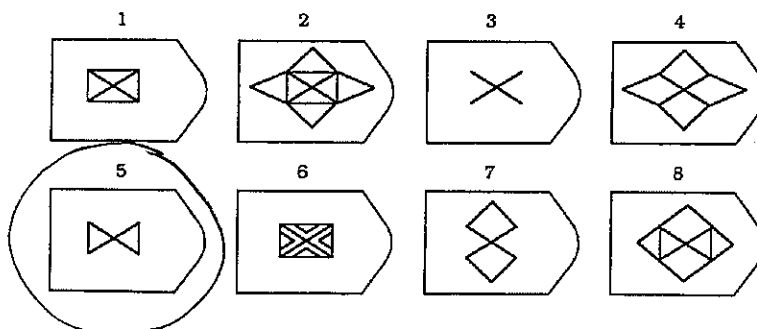
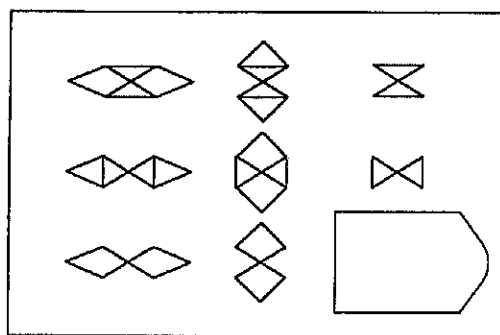
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Please choose the image that best completes each of the following patterns.

### PATTERN 1

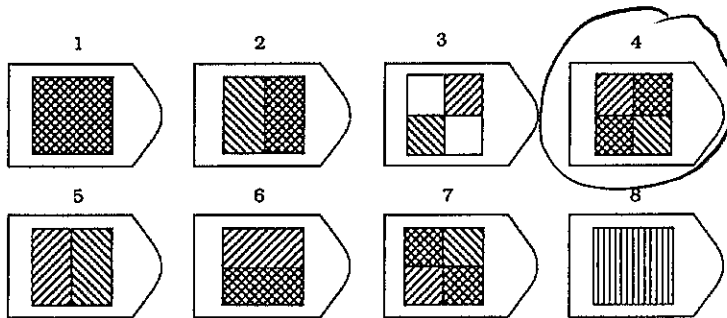
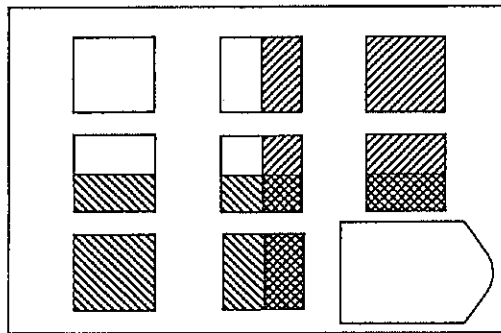


### PATTERN 2

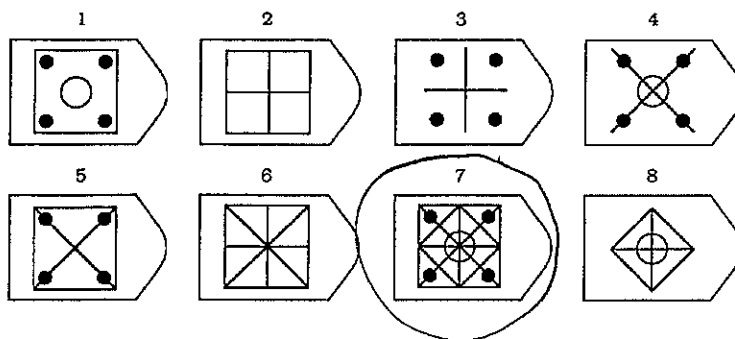
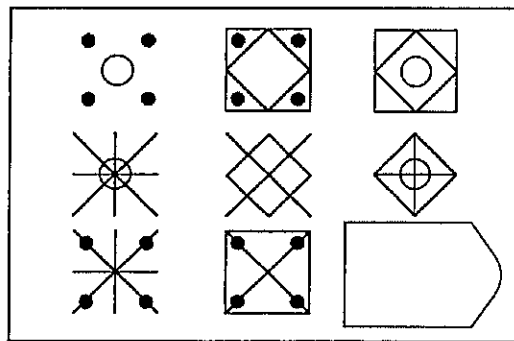


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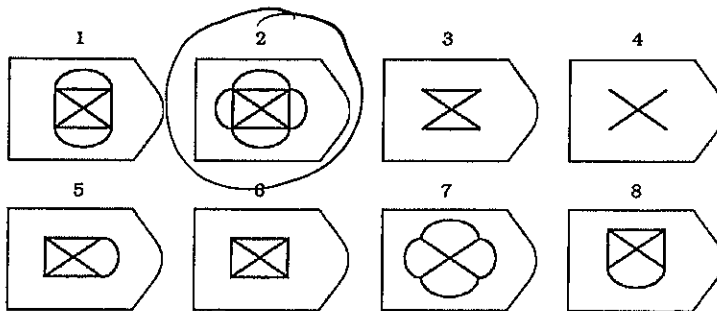
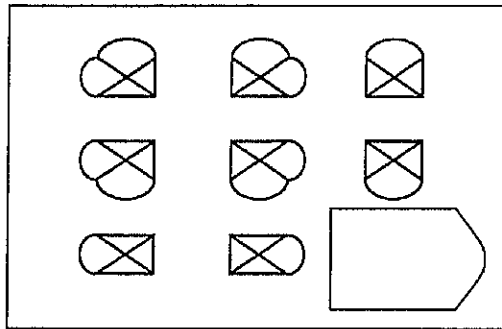
**PATTERN 3**



**PATTERN 4**



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

- C** 1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.
- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
  - B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - C** C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
- D** 2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
- ~~A~~ A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - ~~B~~ B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - ~~A~~ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - D** D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
- A** 3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.
- A** A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - ~~B~~ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - ~~C~~ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - ~~D~~ D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
- C** 4. The rival gangs used graffiti to define their territorial boundaries.
- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - C** C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

- ☐ 5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☒ The plumber fixed the pump that had burst and flooded the basement.
  - ☒ Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☐ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

- ☐ 1. A balloon floating is like...
- ☐ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - ☒ C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - ☒ D. A cloud in the sky. They are similar because they both float and are carried by the wind.
- ☐ 2. Catching a cold is like...
- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - ☐ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48840

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A40250026  
Version B

GROUP: T8

18

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
A ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat  
☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
C ☐ a. The magma becoming colder  
☐ b. Gas bubbles forming in the magma  
☒ c. The surrounding crust becoming hotter  
☐ d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
C ☐ a. A = erosion, B = deposition, C = uplift and erosion  
☐ b. A = erosion, B = biochemical precipitation, C = uplift and deposition  
☒ c. A = dissolution, B = biochemical precipitation, C = uplift and erosion  
☐ d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
B ☐ a. Human activities are the primary cause of the greenhouse effect.  
☒ b. Natural processes are the primary cause of the greenhouse effect.  
☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
☐ e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
C ☐ a. Reservoir A has a shorter residence time than Reservoir B.  
☐ b. Reservoir B has a shorter residence time than Reservoir A.  
☒ c. Reservoir A and Reservoir B have equal residence times.  
☐ d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
C ☐ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☒ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would affect ocean acidification ~~mostly~~ because the ocean is the root to all the living things and the carbon will affect the ocean acidification by adding the carbon dioxide. For example all of the sea animals would be affected and alot of people that only eat seafood would be really hurt and they would have nothing to eat not only them but stores sells would go down and you are killing off innocent animals, Also within the ocean acidification there are non living things but the water needs to <sup>have</sup> less atmospheric carbon dioxide. This will have both negative and positive feedback loops to the process because you are looking out for the well being of others and also saving living and non living things that may or may not be beneficial!

g 1

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

?<  
This would increase volcanism & affect Earth's atmospheric temperature very much so, when large ash clouds erupt they are extremely huge and hot putting all kinds of acids and things in the air, so if there was a sudden increase this would make the temperature rise and some environmental changes might take place and also with the heat rising it may affect the greenhouse because the temperature will go up and the gases will be engaging more and producing more light within the greenhouse. This will cause the infrared to be more predominant and this may can be a good or bad thing depending on how high the temp. gets from the ash clouds.

2

18

Extra credit (2 points).

How are evaporation and degassing similar and/or different? Evaporation & degassing are similar because they both disappear and have a process of coming back in a different form, depending on the situation that is at its hands. Different because one is in above and one is under.



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

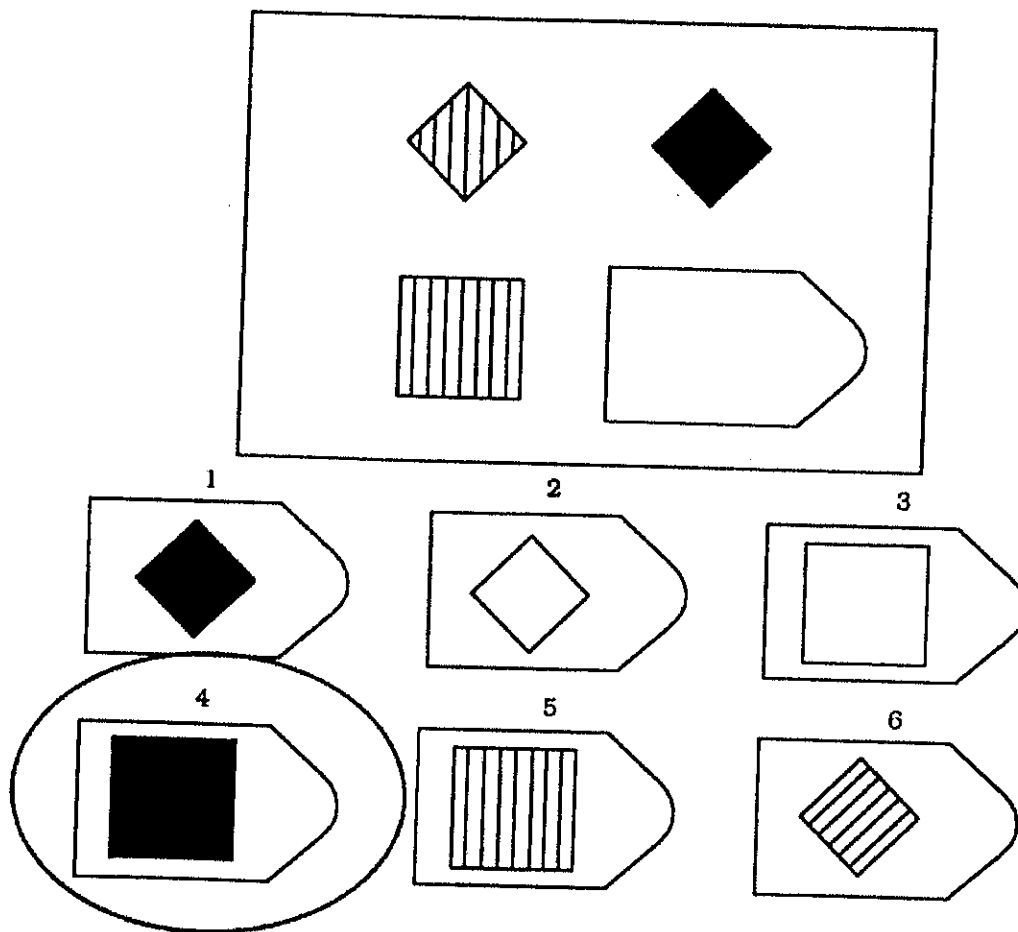
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

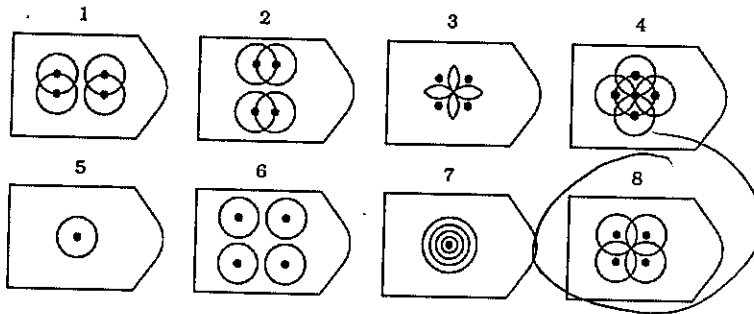
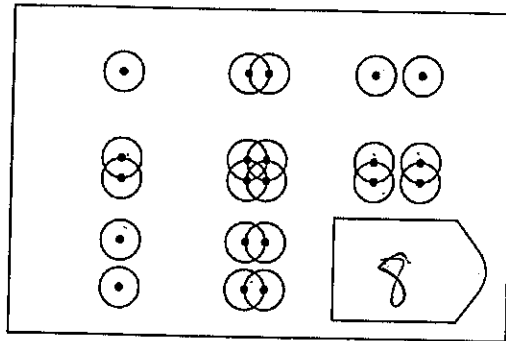


**Answer: 4**

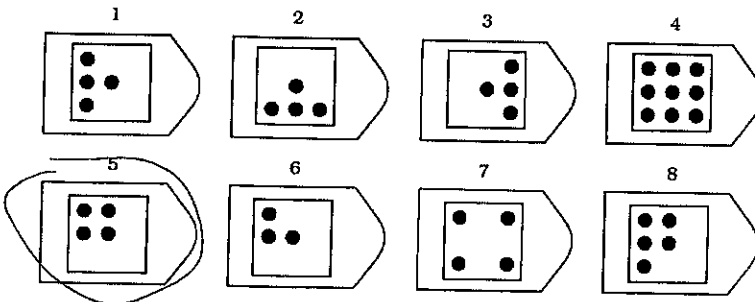
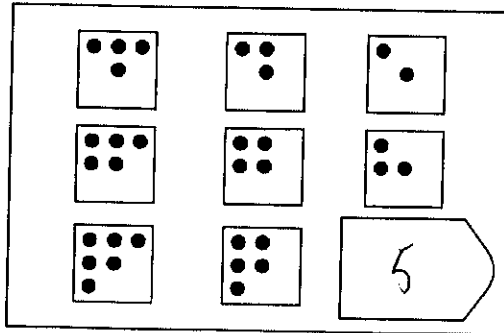
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Please choose the image that best completes each of the following patterns.

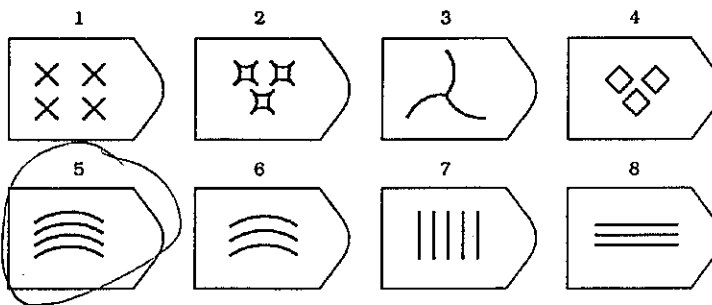
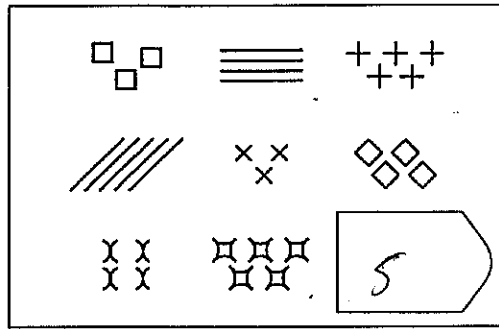
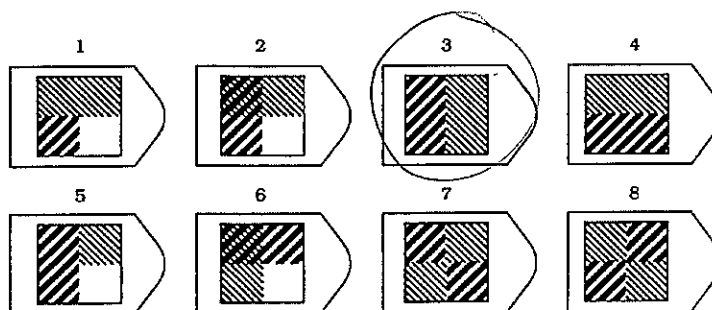
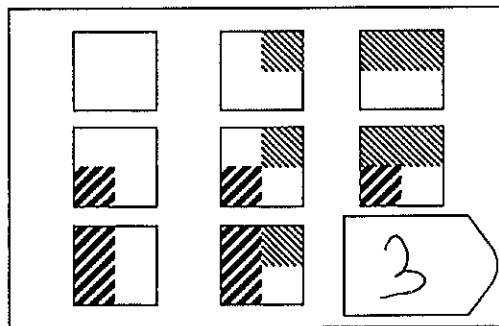
### PATTERN 1

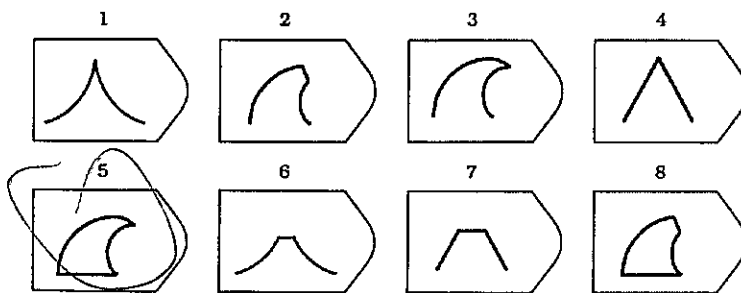
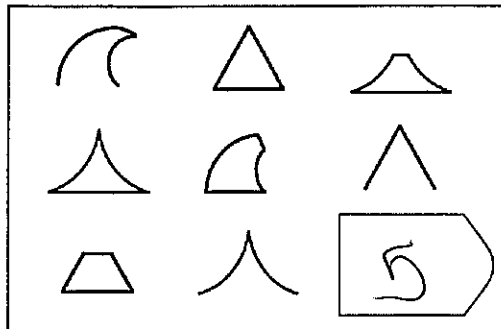


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- ☒ D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48223

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

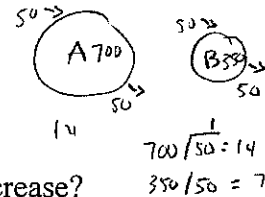
STUDENT NAME: A40006739  
Version B

GROUP: T9

60

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - A = erosion, B = biochemical precipitation, C = uplift and deposition
  - ☒ A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - ☒ Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- ~~c.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

18

An increase in atmospheric carbon dioxide would increase ocean acidification. ~~Meaning there would be an increase of pH levels in the ocean.~~ An increase in  $\text{CO}_2$  in the oceans means there is also an increase of  $\text{CO}_2$  in the atmosphere. An increase of  $\text{CO}_2$  also means there is an increase in atmospheric and ocean temperatures. An increase in atmospheric temperature would mean an increase in evaporation, and an increase in cloud formation. In a positive feedback loop an increase of cloud formation creates more energy, making the atmospheric temperature go up. As the temperature rises more  $\text{CO}_2$  is emitted into the atmosphere and also more  $\text{CO}_2$  in the oceans, which will increase ocean acidification. However, in a negative feedback loop an increase in cloud formation could cause blockage of the sun, which would decrease the atmospheric temperature and the ocean temperature, which would then decrease the  $\text{CO}_2$  in both reservoirs as well. This would make the ocean pH level less acidic. Although, cooler water does absorb more energy from the sun, which will then heat the atmosphere and the cycle begins all over again...

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism were to suddenly increase dramatically on Earth and erupt large ash clouds, we would have a hard time receiving Solar radiation from the sun, due to the ash blockage. Without Solar radiation from the sun the greenhouse effect would not be able to heat the atmosphere, and temperature would decrease.

22 The greenhouse effect is a process in which the solar energy from the sun heats the Earth. The energy from the sun does not always absorb well, but it absorbs easiest when the radiant energy is visible. It becomes visible once it reaches the Earth's surface. Once the energy reaches the surface it is either absorbed and re-emitted into the atmosphere, or it is reflected back into the atmosphere and into space. Energy that is reflected back into space cannot heat the Earth. The energy that is absorbed and re-emitted into the atmosphere turns into Infrared, or heat, energy. The re-emitted energy then continues the process of being reflected or absorbed by the atmosphere then traps the infrared energy, which then heats the earth.

However, the large ash clouds could also emit more  $\text{CO}_2$  in the atmosphere and oceans, which would also increase the temperature in the atmosphere and ocean.

So overall, the temperature is not certain

60

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is different from degassing because evaporation is the transformation of liquid to gas, and degassing is taking the liquid from a solid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

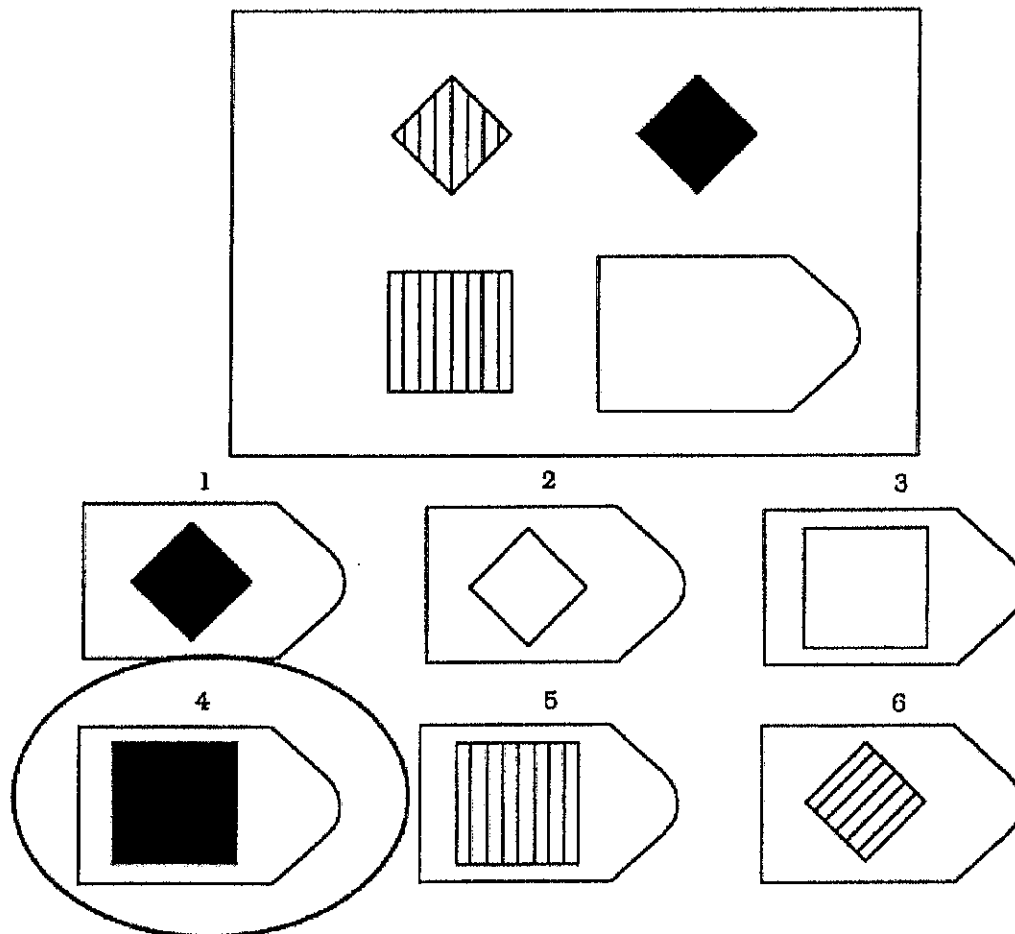


# Analogical Assessment

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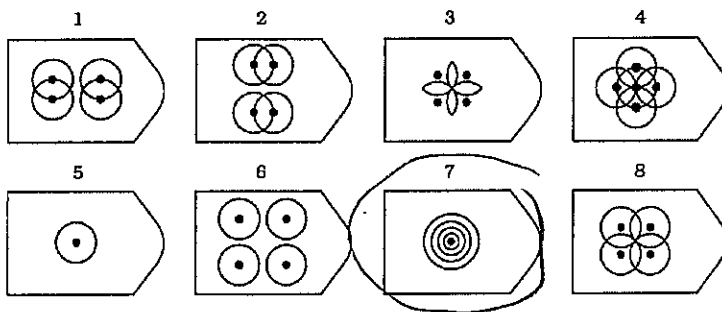
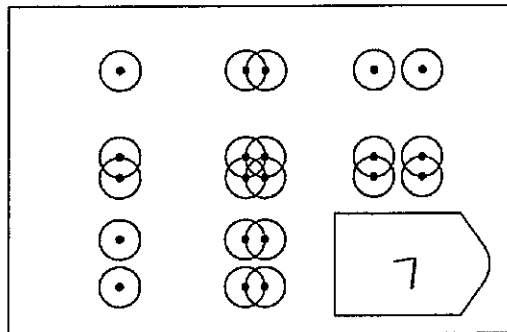


**Answer: 4**

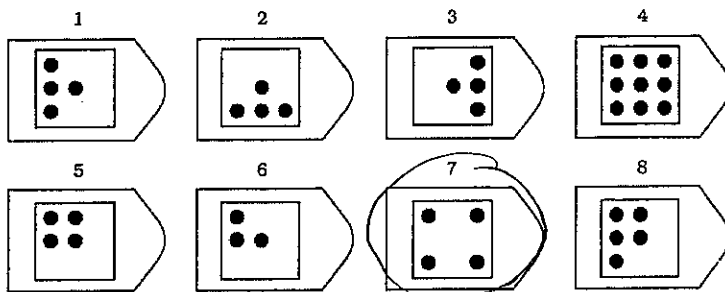
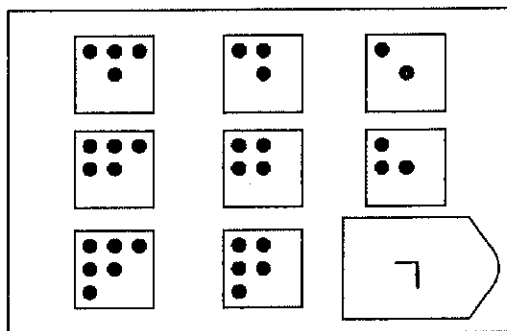
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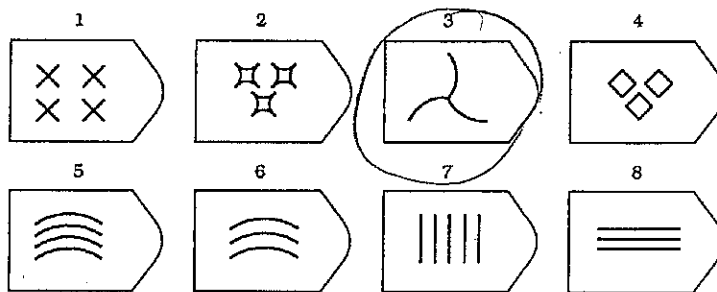
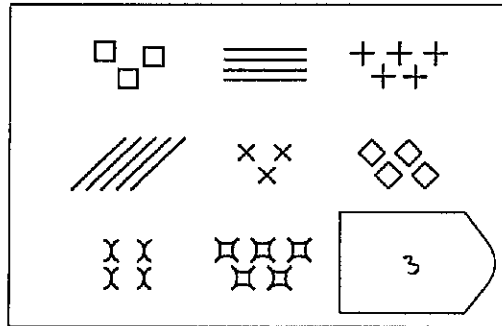
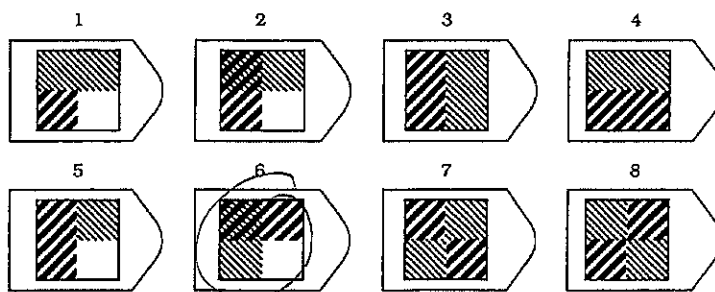
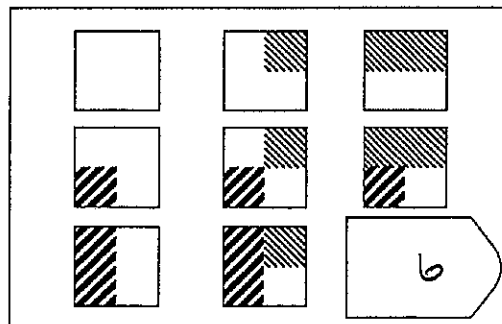
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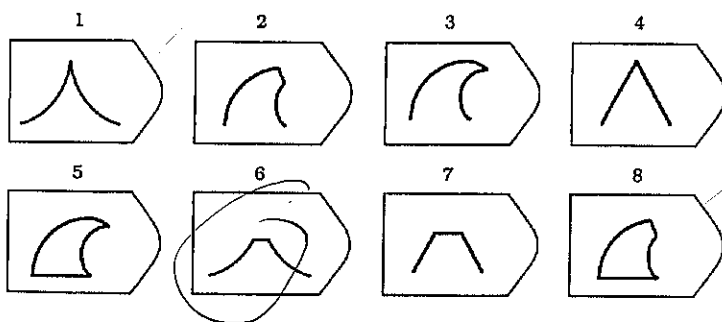
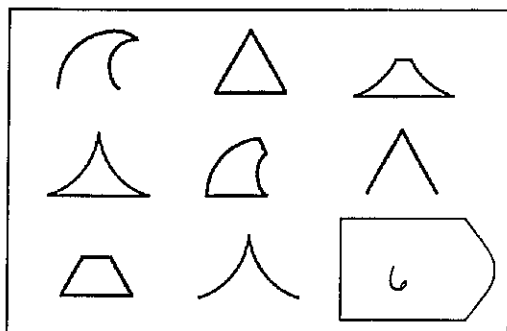
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

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- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

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- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
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- 

Please choose the response that is closest to an analogy that you might make.

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- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 49339

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A40840884

GROUP: T9

87

MULTIPLE-CHOICE. 5 points each (50 points total).

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- ↑ in desert, ↓ in temp. clouds*
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- exp. more buoyant*  
*less dense = rise*  
*hotter magma may be easier than crust*
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A = erosion, B = deposition, C = uplift and erosion
  - b. A = erosion, B = biochemical precipitation, C = uplift and deposition
  - c. A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- to each other and the lake*
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- less temp in ocean higher acidity*

A40840884

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

- B** 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ~~a. The reservoir will eventually disappear.~~
  - b. The reservoir is not in equilibrium.**
  - ~~c. The reservoir is growing smaller.~~
  - ~~d. The reservoir's residence time is 10 years.~~
- A** 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ~~a. The Earth's atmosphere would become colder than it is today.~~
  - ~~b. The Earth's atmosphere would become warmer than it is today.~~
  - ~~c. The Earth's atmosphere would remain about the same temperature as it is today.~~
  - ~~d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.~~
- C** 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ~~a. Reflection of more solar radiation, causing atmospheric temperature to decrease.~~
  - ~~b. Reflection of more solar radiation, causing atmospheric temperature to increase.~~
  - ~~c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase.~~
  - ~~d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease.~~
- B** 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ~~a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.~~
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.**
  - ~~c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.~~
  - ~~d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.~~

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

a)

$\text{CO}_2$  in the atmosphere goes into the ocean

$\text{CO}_2$  in the ocean +  $\text{H}_2\text{O}$  →  $\text{H}^+$  (acid) +  $\text{HCO}_3^-$

The  $\text{CO}_2$  molecules react with water molecules to form carbonic acid. Carbonic acid forms hydrogen ions in some cases & sea shells in other cases. These shells can form into limestone.

→ sea shells

→ hydrogen ions

An increase in  $\text{CO}_2$  in the atmosphere would lead to more  $\text{CO}_2$  going into the ocean. There, more  $\text{CO}_2$  to go with  $\text{H}_2\text{O}$  & make more ocean acidification.

However, more  $\text{CO}_2$  in the atmosphere creates a higher temperature in the atmosphere. This leads to a warming of the ocean. Warming ocean water is a worse environment for ocean acidification. This would lead to a decrease in ocean acidification.

b) Example 1 above is an example of positive feedback.  $\text{CO}_2$  is increasing in the atmosphere,  $\text{CO}_2$  is increasing in the ocean, & ocean acidification is increasing.

Example 2 is an example of negative feedback. There is more  $\text{CO}_2$ , higher temp. in the atmosphere, higher temp. in the ocean, but this leads to less ocean acidification. This is a change in the opposite direction.

140840884

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25

a) This would decrease the amount of infrared rays being used in the greenhouse effect, causing a decrease in temperature. Since the ash clouds block the sun's visible rays which are absorbed & converted into infrared heat, less infrared rays would be radiated into the atmosphere & less would be absorbed by greenhouse gases in the atmosphere. Less infrared heat means less temperature in the atmosphere, less infrared heat means the greenhouse would also tend to less re-radiation. However, the increased volcanism also causes the opposite effect. More ash clouds means there would be a rise in  $CO_2$  in the atmosphere. Less  $CO_2$  would be converted into  $O_2$  on the Earth if the ash cloud is blocking the sun. Since there would more  $CO_2$  trapped in the atmosphere, more  $CO_2$  will be used as a greenhouse gas, causing an increase in atmospheric temperature. Finally, the increase in visible light in the atmosphere, due to the ash clouds, would directly affect the temperature because visible light can't be used in the greenhouse effect. The greenhouse gases need  $CO_2$  or infrared rays to increase temperature!

87

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Similar - Both involve liquid, gas, & water.  
Difference - Evaporation is the conversion of  $H_2O$  from a liquid to a gas state. Degassing is when gas, like  $CO_2$ , leaves the liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

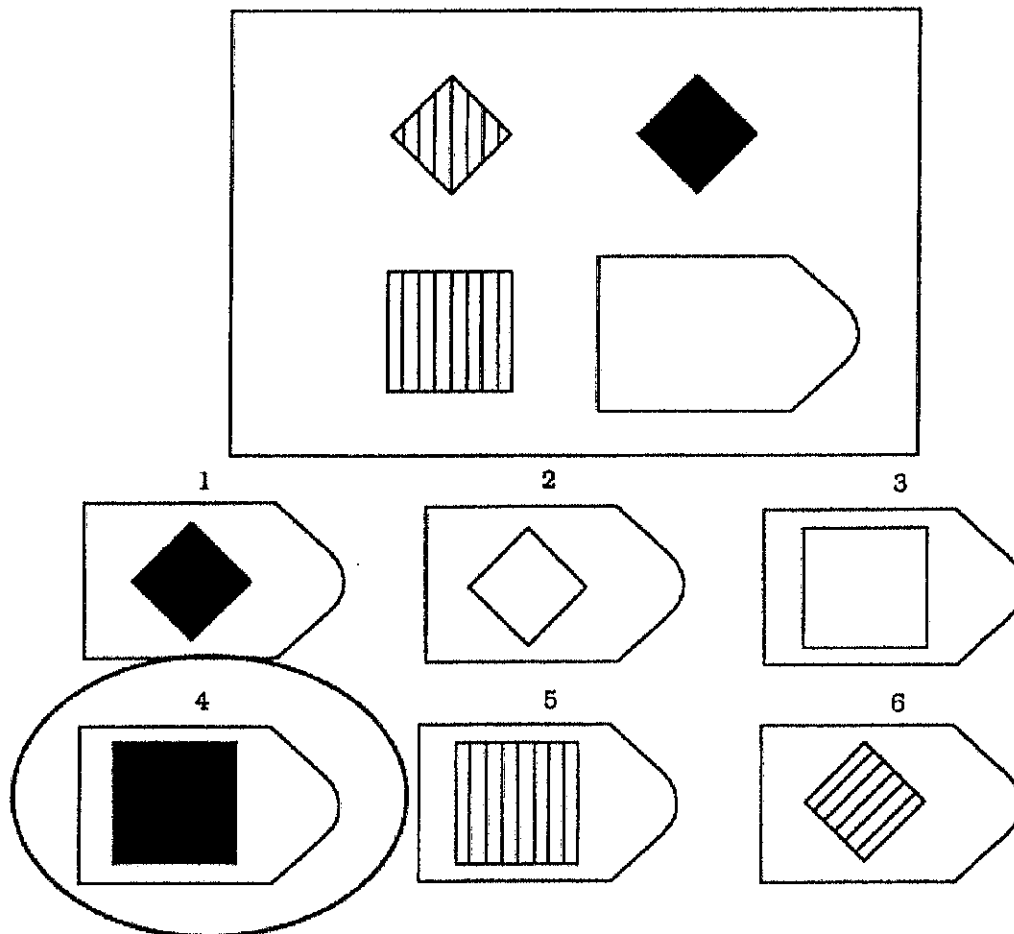




# Analogical Assessment

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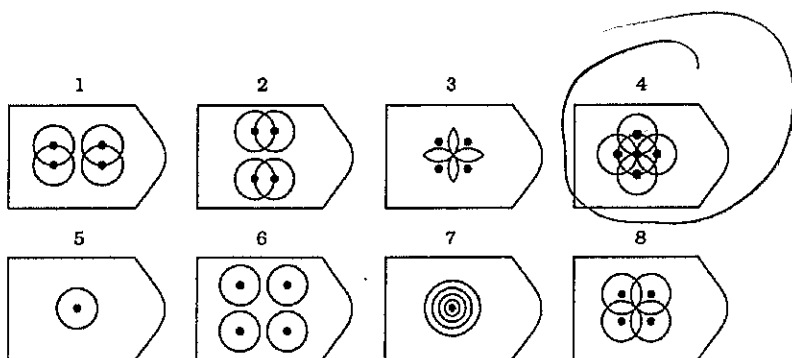
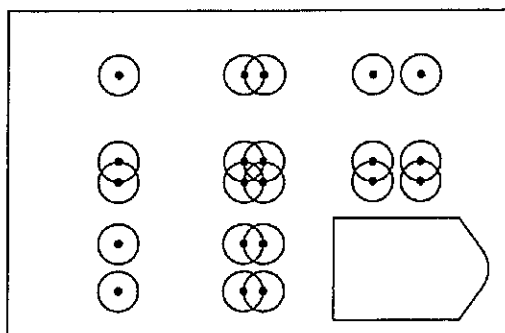


**Answer: 4**

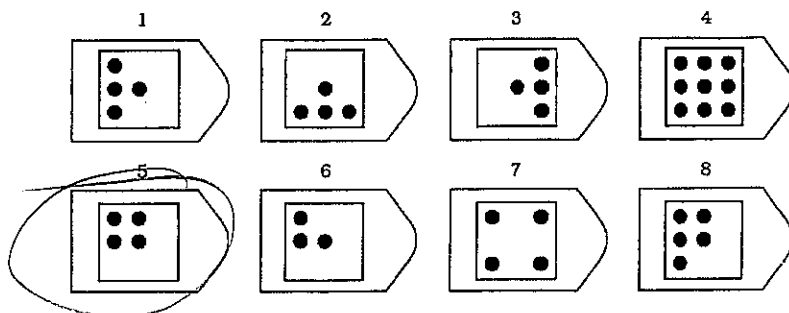
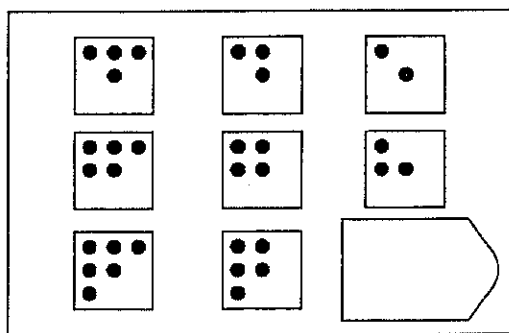
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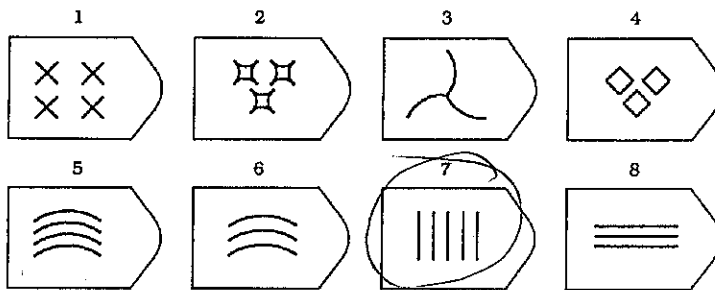
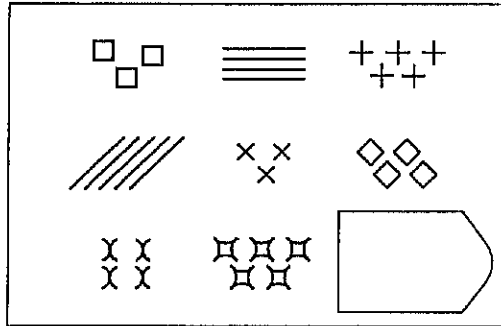
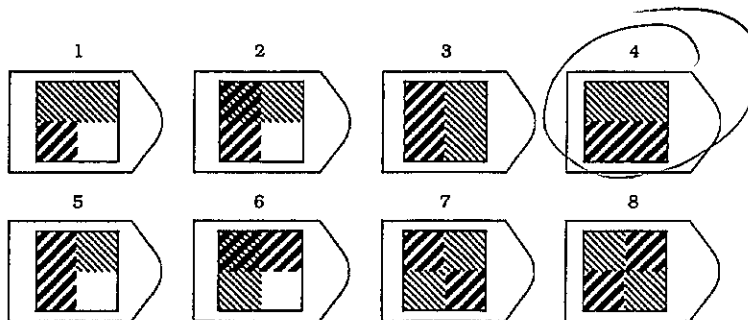
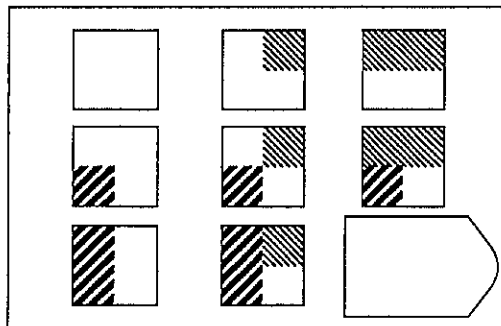
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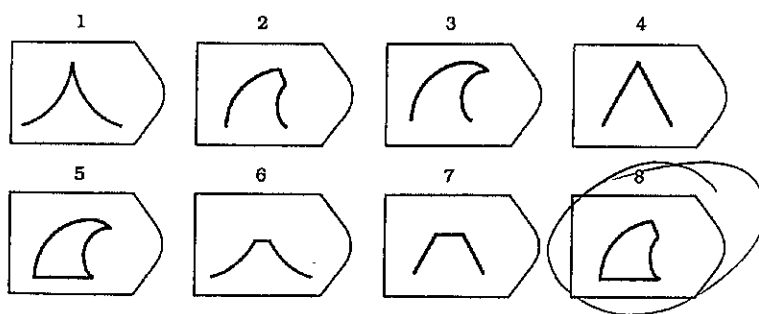
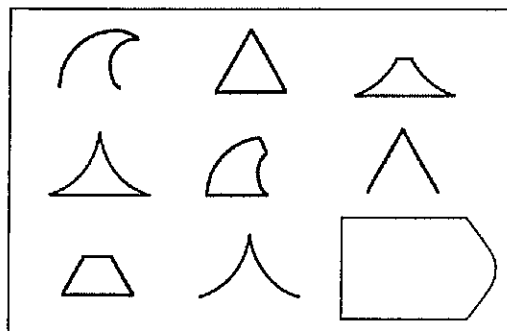
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**PATTERN 3****PATTERN 4**

**PATTERN 5**

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2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

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- A. Dew forming. They are similar because they both involve a drop in temperature.
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What is your age? 21 years

What is your home zip code? 48823

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- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A41696110  
Version B

GROUP: T9

69

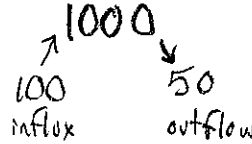
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- ~~a.~~ Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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- ~~a.~~ The magma becoming colder
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  - ☒ d. Crystals forming in the magma
- D 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A diss.. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C uplift.
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  - ☒ d. A = dissolution, B = deposition, C = uplift and deposition
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- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - ~~b.~~ Natural processes are the primary cause of the greenhouse effect.
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- ~~a.~~ Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - ~~c.~~ Reservoir A and Reservoir B have equal residence times.
  - ~~d.~~ More information about Reservoir A and Reservoir B is needed.
- A      B  
→ 2x →    → x →
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- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ~~b.~~ A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?

- B
- ~~a.~~ The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ~~c.~~ The reservoir is growing smaller.
  - ~~d.~~ The reservoir's residence time is 10 years.



8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- B
- ~~a.~~ The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ~~d.~~ The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

~~9.~~ Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ~~b.~~ Reflection of more solar radiation, causing atmospheric temperature to increase
  - ~~c.~~ Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ~~d.~~ Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

B

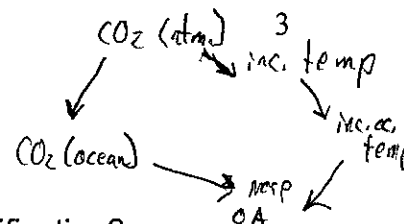
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- C
- ~~a.~~ Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive-feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ~~d.~~ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



A41696110

ISP 203A: GLOBAL CHANGE  
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SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

inc. CO<sub>2</sub> → inc. pH

inc. CO<sub>2</sub> → inc. pH → inc. evap. → inc. degree,

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

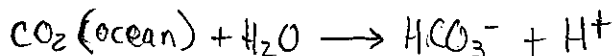
20

An increase in atmospheric carbon dioxide would cause ocean acidification to increase. Ocean acidification is the process by which CO<sub>2</sub> in the atmosphere is converted to hydrogen ions in the ocean, increasing the pH and increasing acidity.

CO<sub>2</sub> (atmosphere)

degassing

The CO<sub>2</sub> in the atmosphere becomes CO<sub>2</sub> in the ocean through the process of degassing. Once the CO<sub>2</sub> is in the ocean it reacts with the water molecules to



produce bicarbonate and hydrogen ions. The hydrogen ions are what cause the acidity of the ocean. With an increase in atmospheric CO<sub>2</sub>, more CO<sub>2</sub> will be added to the ocean. The increase of CO<sub>2</sub> in the atmosphere causes more ocean acidification to occur, increasing the amount of hydrogen atoms produced and increasing the pH. As carbon dioxide in the atmosphere increases, this will continue to increase the ocean acidification, demonstrating a positive feedback loop because there is an increase in the process. However, as atmospheric CO<sub>2</sub> increases, this also increases the Earth's atmospheric temperature. An increase in temperature will cause (more evaporation and degassing of CO<sub>2</sub>) within the ocean, back into the atmosphere. This would then decrease ocean acidification, demonstrating a negative feedback loop because the system is returning to equilibrium by decreasing the process of ocean acidification. An increase in atmospheric carbon dioxide would affect ocean acidification by first increasing it, but then it would decrease over time through a negative feedback loop.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?  $SO_2$

Your answer should include:

- ✓ a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- ✓ b. Clear connections between events and changes in atmospheric temperature.

22

If volcanism on Earth suddenly increases dramatically, this increase would cause a decrease in Earth's atmospheric temperature. Volcanos release  $CO_2$ , a common greenhouse gas, that contributes to the greenhouse effect. This effect explains that there are gases in the atmosphere which trap infrared radiation. The sunlight is able to pass through these gases; however, once the light reaches Earth and is converted to IR radiation, this heat cannot escape back through the gases. It is known as the greenhouse effect because these gases trap <sup>expl.</sup> the heat, making the atmosphere warmer.  $CO_2$  emissions from volcanos increase this effect. However, if the volcanoes are erupting large clouds of ash, this will have opposite effects. The ash clouds contain  $SO_2$  ~~ASH~~ a gas which reflects sunlight. With the introduction of this gas into our atmosphere, it would act as a type of shield, reflecting the visible light, ultimately decreasing Earth's atmospheric temperature. This effect has been demonstrated in the past by looking at atmospheric temperatures after volcanic eruptions. The data shows that temperatures have decreased after these events due to the reflection of sunlight by  $SO_2$ . If the Earth has a sudden increase in volcanism, particularly volcanoes that erupt large ash clouds, the Earth's atmospheric temperature would decrease.

69

Extra credit (2 points).

2

or How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar because both show the transfer of carbon dioxide or water from one reservoir to another. They are different because evaporation exhibits a phase change from liquid to gas, whereas in degassing, the mater stays in the gas phase.

A41696110

**ISP 203A: GLOBAL CHANGE**  
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5

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

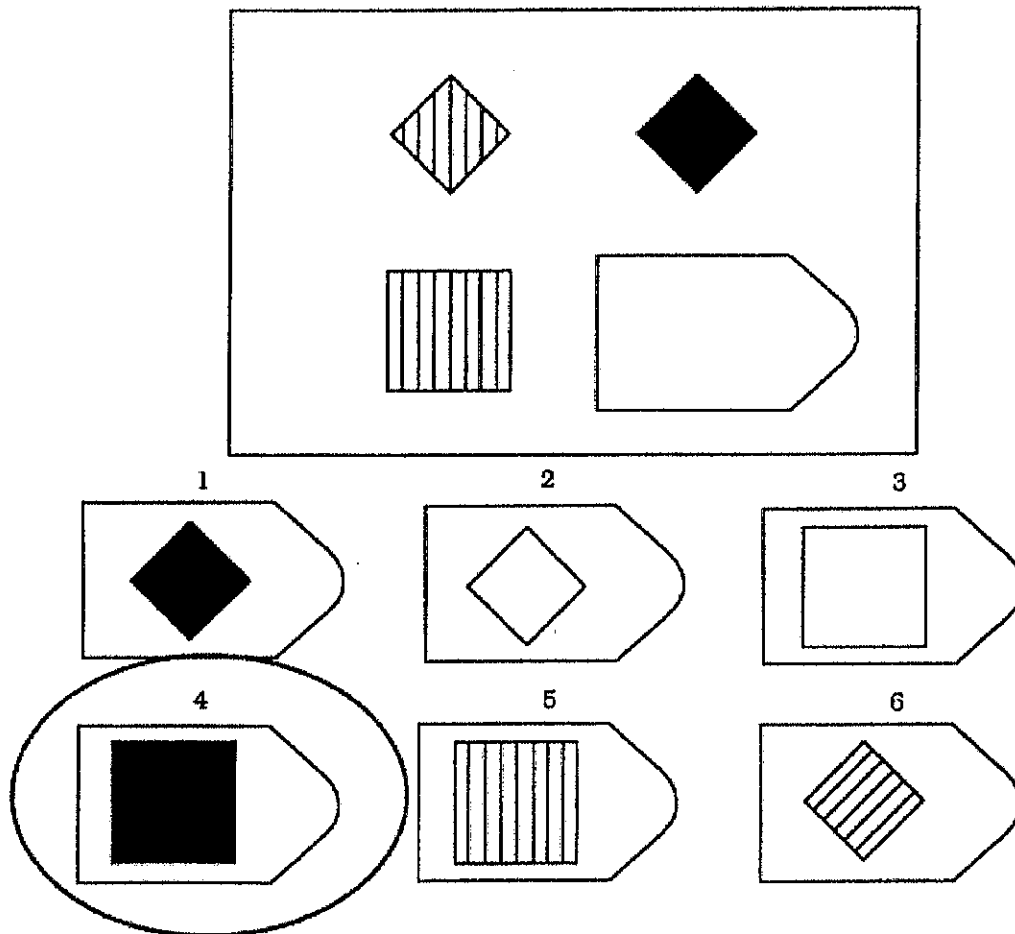
**Thoughtfully complete the attached survey**



# Analogical Assessment

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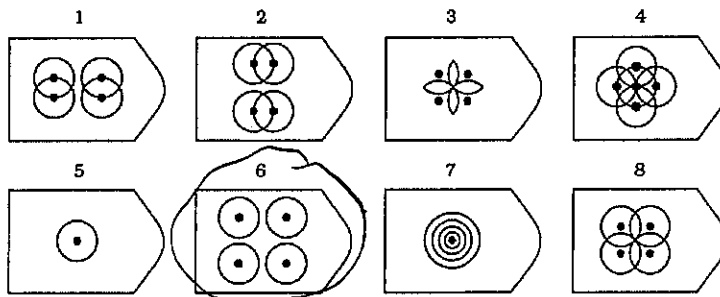
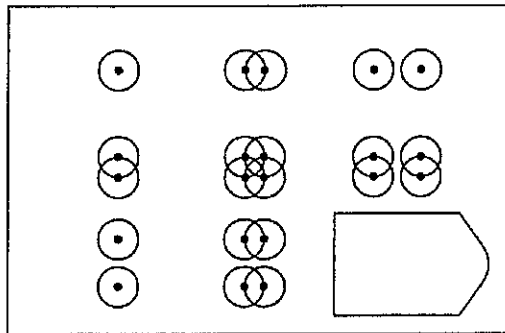


**Answer: 4**

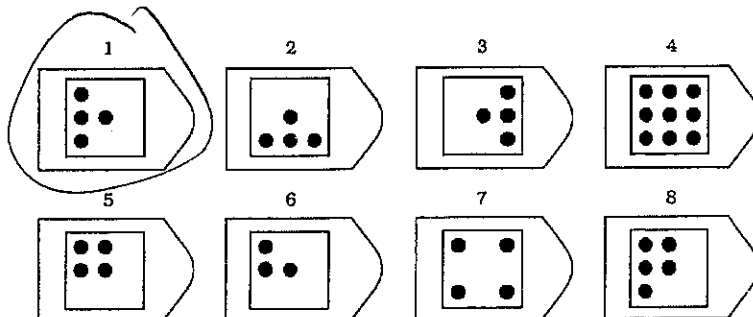
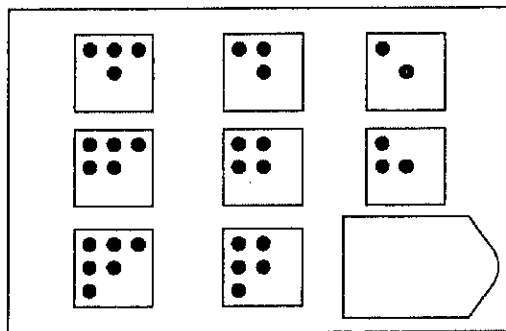
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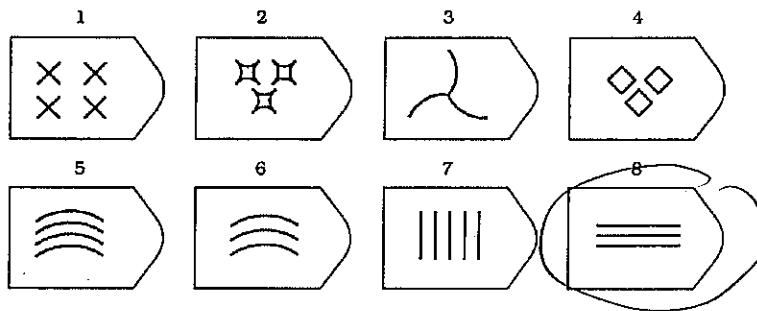
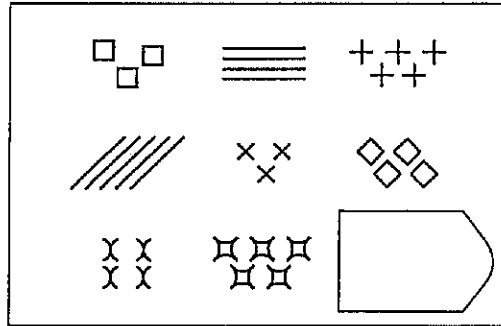
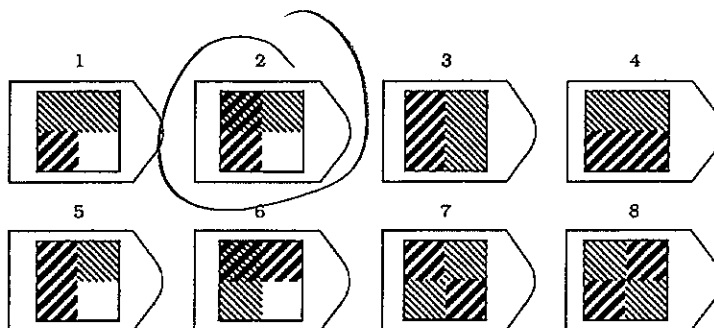
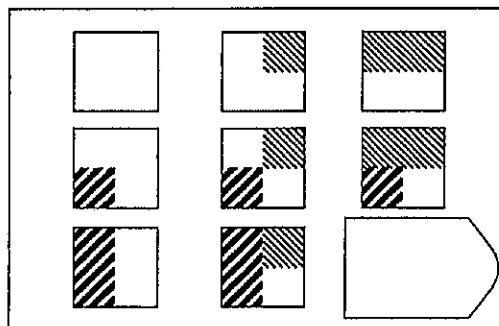
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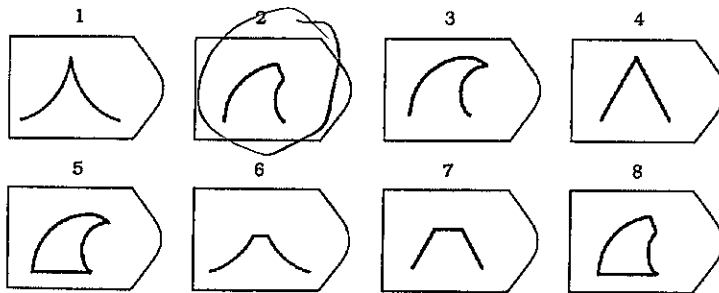
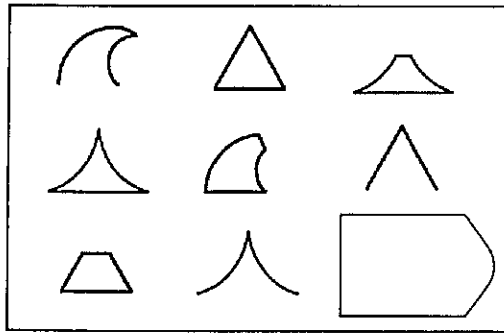


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

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PLEASE CONTINUE ON NEXT PAGE



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PLEASE CONTINUE ON NEXT PAGE

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  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

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- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48107

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

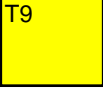
- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A42097140  
Version B

GROUP



50

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - A = erosion, B = biochemical precipitation, C = uplift and deposition
  - A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

$$2000/100 = 20$$
$$1000/100 = 10$$

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true? 1000
- a. The reservoir will eventually disappear.
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  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
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  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

- 15
- \* Ocean acidification is the process of carbon<sup>?</sup> through the oceans. Carbon from the atmosphere goes into the ocean. When this  $\text{CO}_2$  is in the ocean it is combined with water or  $\text{H}_2\text{O}$  to make carbonate which in turn creates hydrogen ions. This process creates seashells which end up as limestone in the earth. Limestone is the rock formation consisting of the most carbon.
- \* A negative feedback loop would be adding carbon to the atmosphere. This would originally add more carbon into the oceans, and heat<sup>?</sup> the ocean water which would in turn make carbon more soluble in the water so less carbon is re-admitted to the atmosphere.
- \* A positive feedback loop would entail decreasing carbon in the atmosphere. This would decrease the amount of carbon in the ocean, colder which means it would be holding on to less carbon and the carbon in the atmosphere would increase to keep the system in equilibrium.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

15

The greenhouse effect is the process through which the Earth's atmosphere is heated due to radiation from the sun. The sun radiates visible light. Visible light has short wavelengths, therefore it is not absorbed by the greenhouse gases (argon, CO<sub>2</sub>, water vapor). This means that visible light goes to the earth's surface. The light can now do two things: get lost in space by being reflected off the surface or get absorbed. Visible light that is absorbed is made into infrared light. Infrared light is reflected off the surface and is caught by the greenhouse gases. The gases are then circulated back to the atmosphere or bounced back? to the surface and go through the greenhouse effect cycle again.

The ash would decrease the temperature in the atmosphere because not as much visible light would be able to get through to the ground and eventually to the atmosphere to be caught by greenhouse gases that heat the Earth. The decrease in temperature would cause the earth to reflect more heat. In turn increasing the temperature.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

degassing is getting rid of chemicals and evaporation is a change of state

X

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

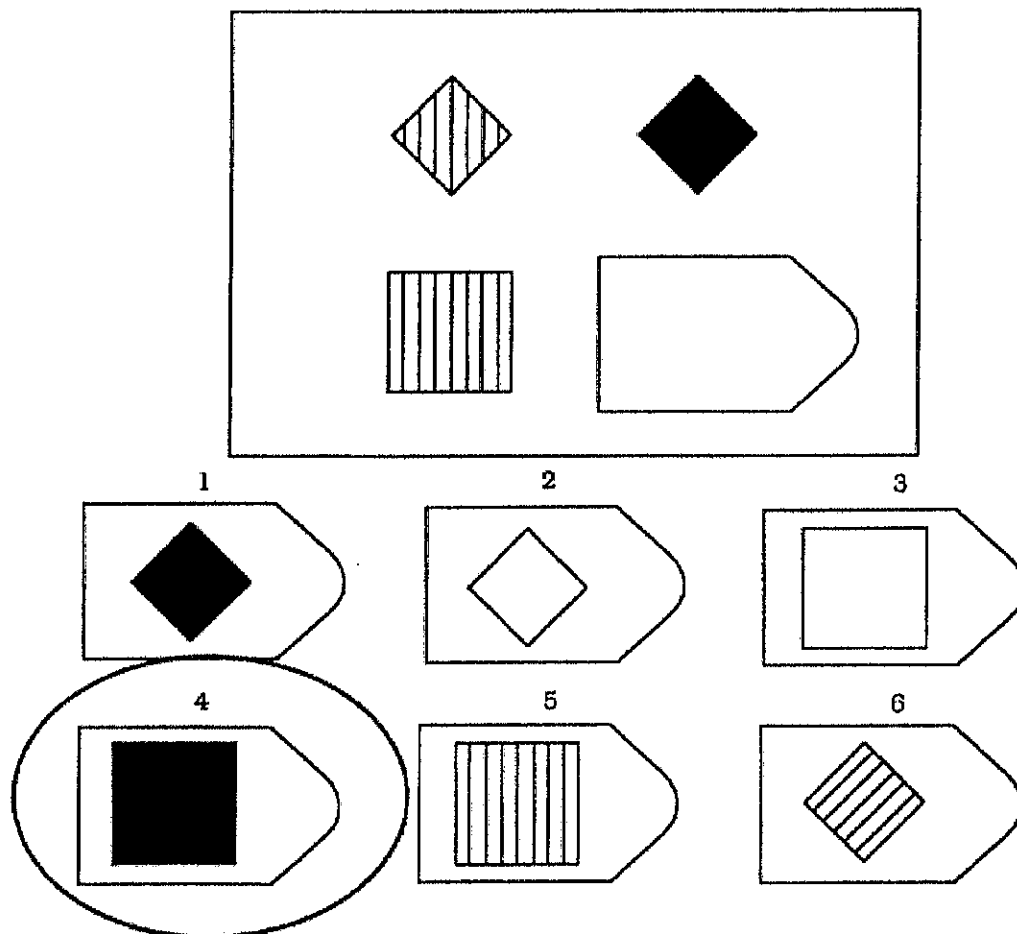




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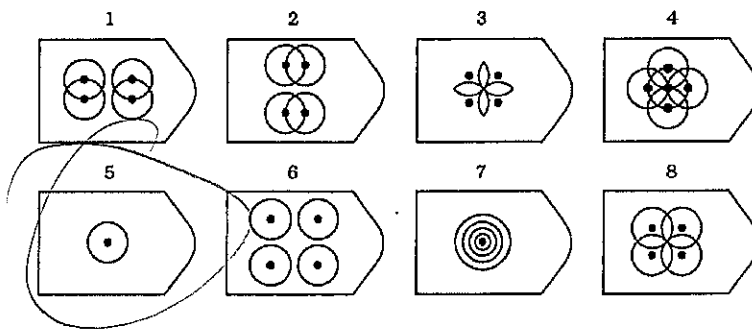
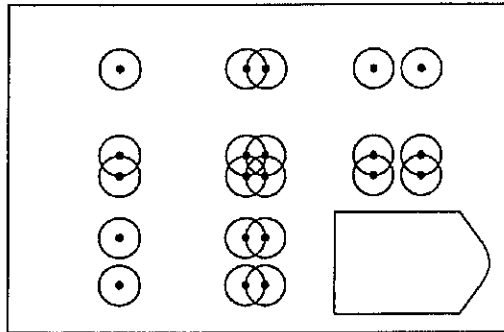


**Answer: 4**

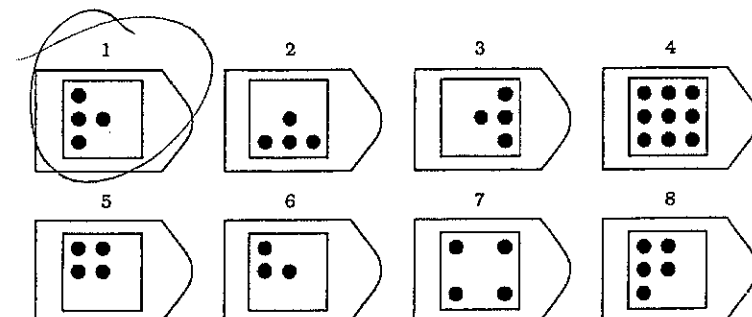
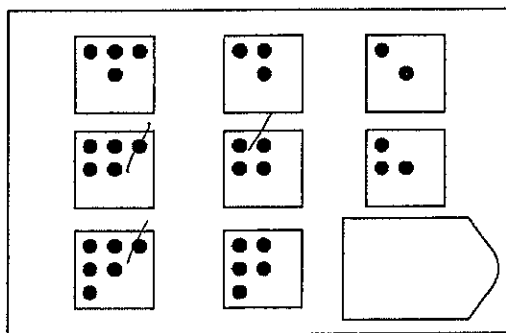
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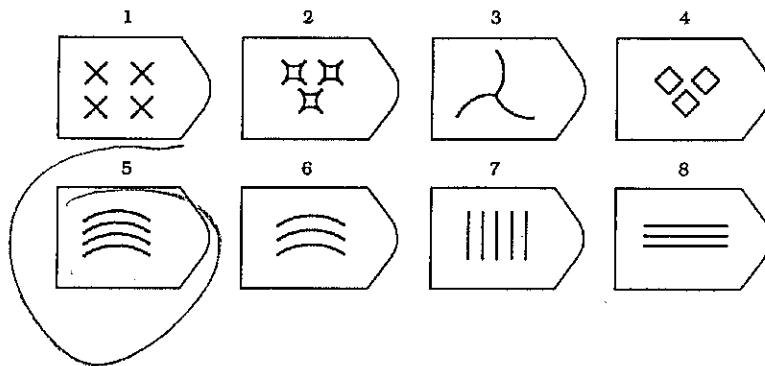
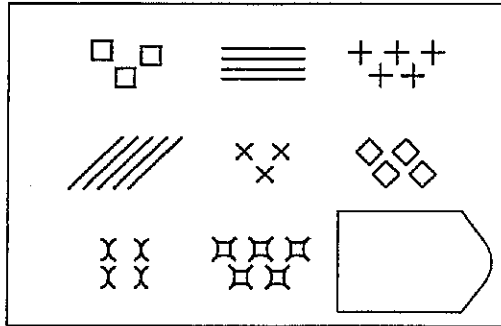
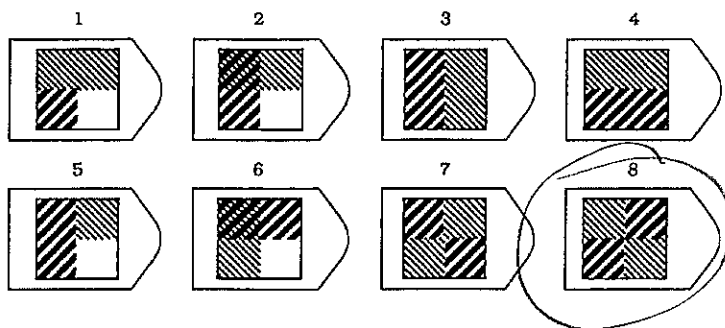
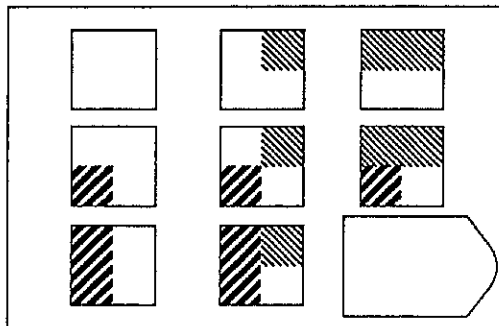
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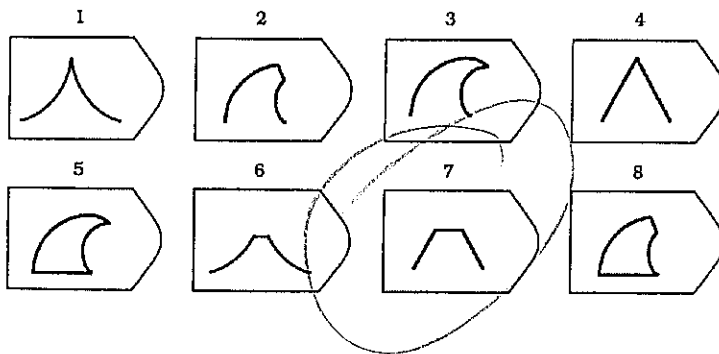
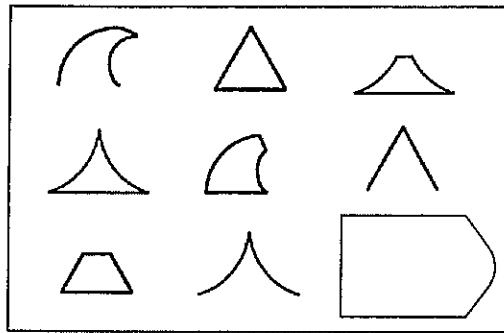
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

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- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 40346

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42254860  
Version A

GROUP: T10

80

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder<sup>\*</sup>
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma <sup>x</sup>
2. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed <sup>x</sup>
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere <sup>x</sup>
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere <sup>x</sup>
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☒ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$\begin{array}{r} 1000 \quad 500 \\ 100 \quad 100 \\ \hline 10 \quad 2 \end{array}$$

20 10

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- A 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
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- B 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- ~~10.~~ 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a. Ocean acidification is the result of increasing carbon dioxide in the atmosphere. With more  $\text{CO}_2$  in the atmosphere, more is cycled through the oceans as well. Carbon dioxide gas when it reacts with water, splits apart to form the bicarbonate ions and hydrogen ions. As more carbon dioxide enters the ocean, more and more bicarbonate and hydrogen ions do as well. As this concentration grows higher, it prevents calcium carbonate from being able to form (ions attach to bicarbonate ions instead), ~~which is the~~ and calcium carbonate is what reefs are made up of. Thus, the growth of reefs will be slowed as less calcium carbonate is able to be precipitated. This also can have an effect by making reefs build their skeletons less stably, so they cannot withstand as much wave power, which leaves the shore unaffected.

b. A positive feedback loop of ocean acidification is that as the temperature rises from the increased  $\text{CO}_2$  in the atmosphere, it causes the oceans to become warmer, so more water evaporates, so more water and carbon dioxide is being cycled, then enters back into the water, releasing more bi-carbonate and hydrogen ions and raising ocean acidity higher. A negative feedback would be as the ocean warms due to increased  $\text{CO}_2$ , the water has a harder time dissolving ~~solids~~ <sup>gases like  $\text{CO}_2$</sup> , which can then decrease acidification.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

20

The greenhouse effect helps to explain how solar radiation originally from the sun gets trapped in the atmosphere. Incoming solar energy is usually in long wavelengths which pass through the atmosphere easily because greenhouse gases aren't good at absorbing them. The wavelengths are then either absorbed or reflected by the earth's surface. ~~Wavelengths~~ Wavelengths that are reflected, are lost into space, but wavelengths that are absorbed are re-emitted as short or infrared wavelengths which greenhouse gases are able to absorb. As they absorb the infrared wavelengths, it causes them to get excited and re-emit the infrared wavelength in any direction, including back towards earth surface. These infrared wavelengths can then be re-absorbed and re-emitted, essentially starting the cycle over and "trapping" the energy, which is heat. This causes atmospheric temperatures to rise. The presence of more volcanic ash in the atmosphere would lead to more surfaces being able to reflect long wavelengths (so they are lost in space) and do not get trapped by being absorbed, and heat the atmosphere. With the decrease of surface ice reflecting solar radiation, an increase in volcanic ash would help to reflect more radiation to prevent the atmosphere from heating. If it stops though, there will be a sharp rise in temp.

(erupting/volcanic ash reflecting)

not clear

Extra credit (2 points).

How are evaporation and degassing similar (and/or) different?  
Both evap. and degassing have to do with the increased vibrations of molecules at the surface which allow them to break bonds and move vertically more easily.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

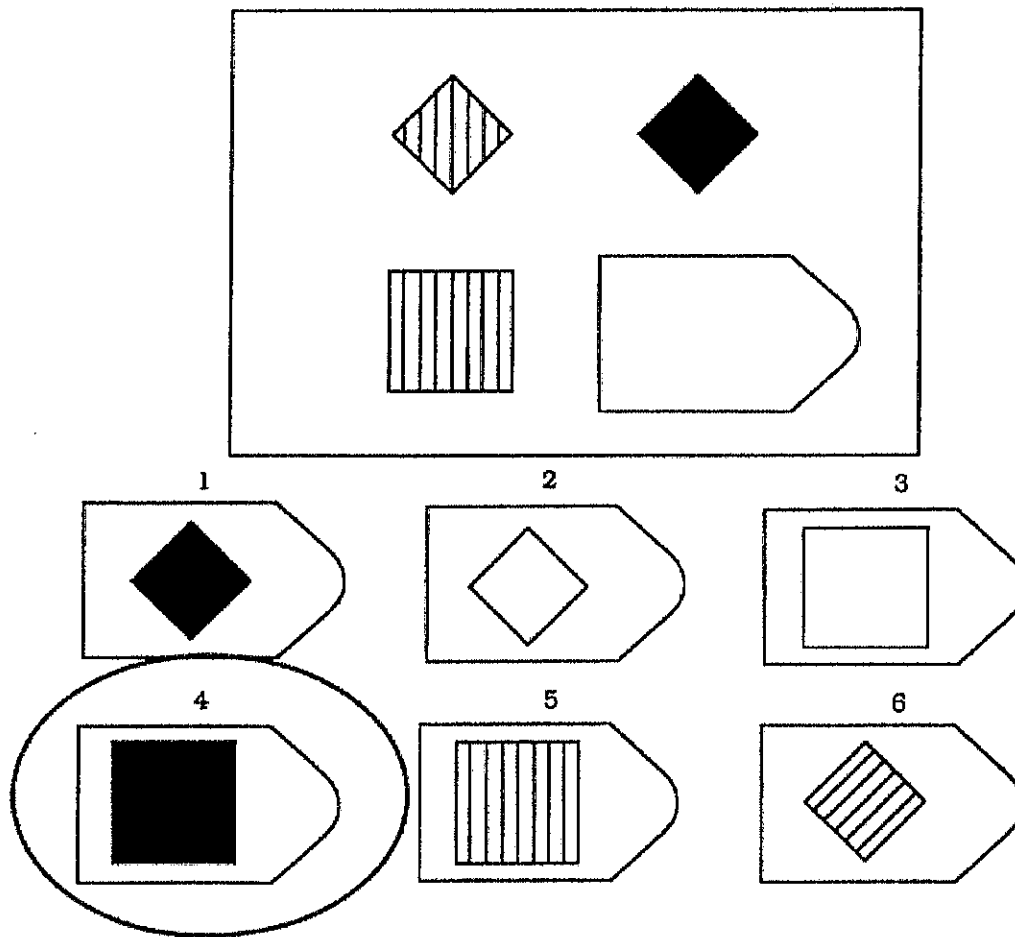
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

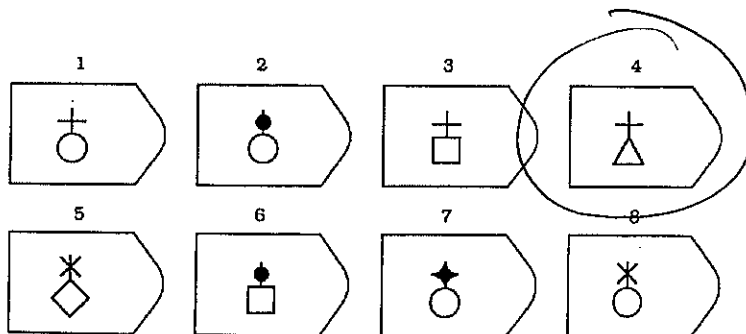
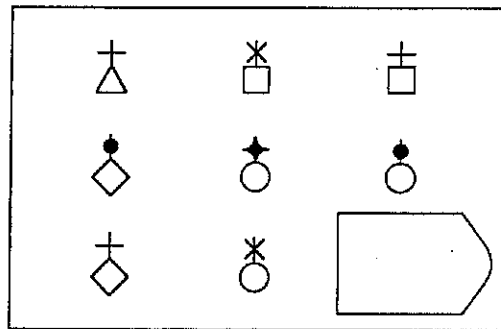


**Answer: 4**

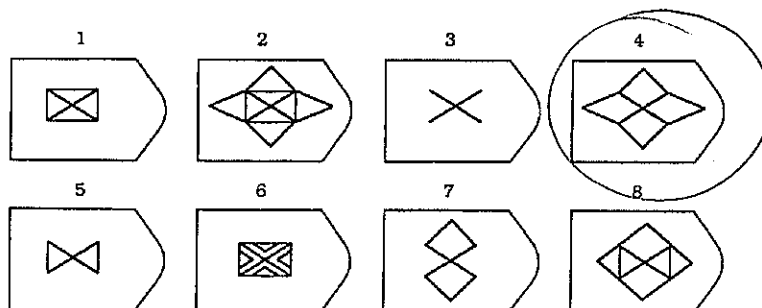
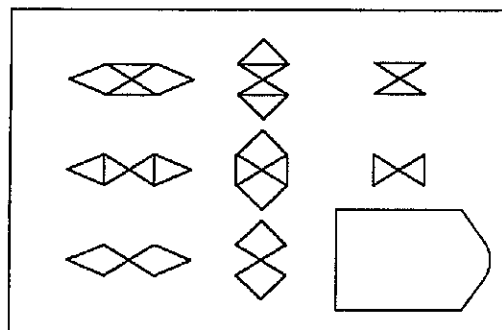
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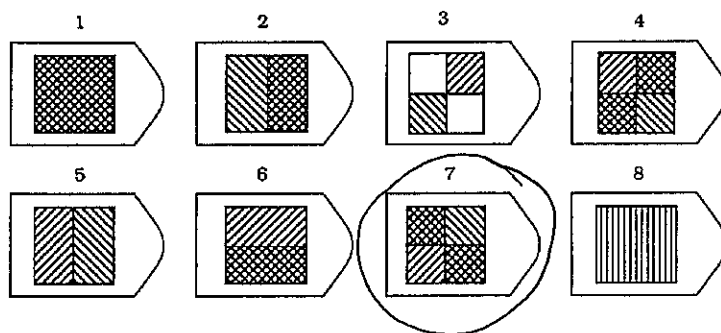
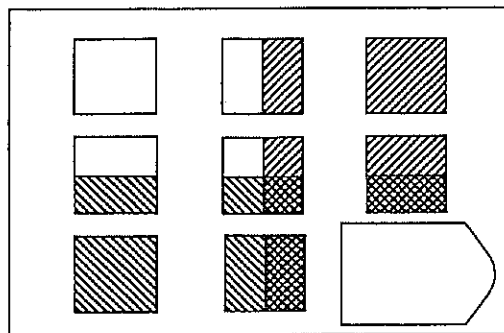
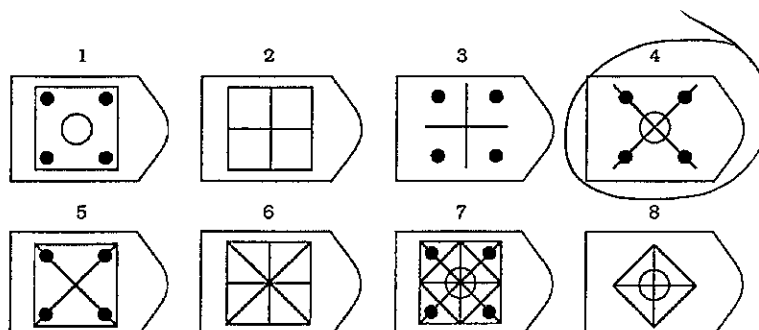
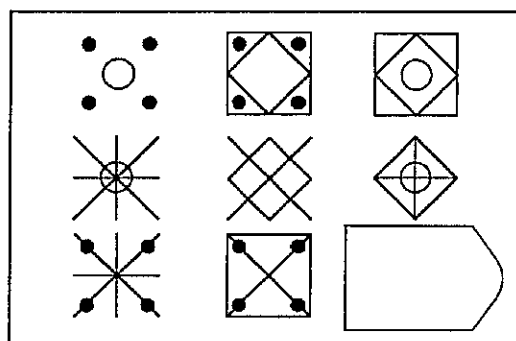
Please choose the image that best completes each of the following patterns.

### PATTERN 1

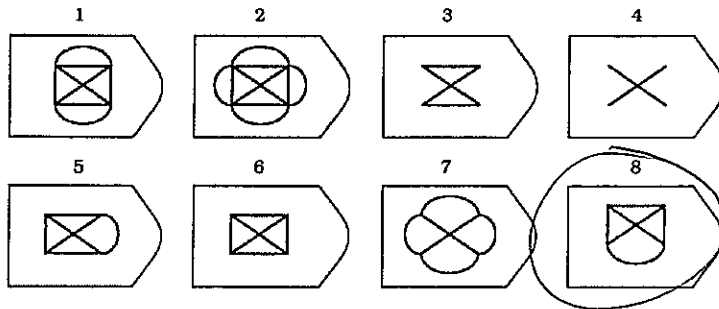
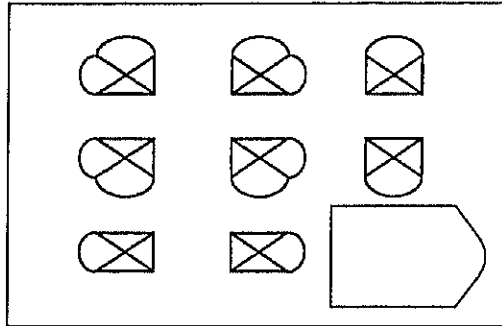


### PATTERN 2



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

☒ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48104

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A43338446  
Version A

GROUP: T10

50

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- C 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - ☒ c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- D 2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- D 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ☒ d. A = dissolution, B= deposition, C= uplift and deposition
- B 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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  - e. The human and natural causes of the greenhouse effect are not understood.
- A 5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- C 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - ☒ c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

- B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- ☒ 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
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- P 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
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- A 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

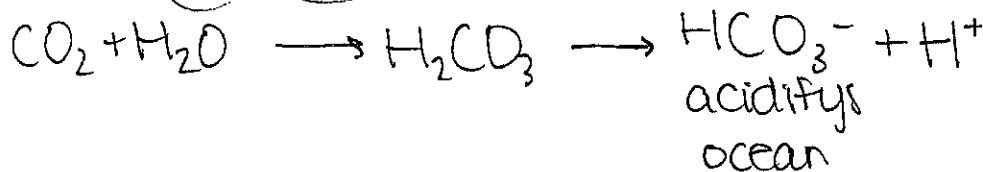
Ocean acidification is caused by the atmosphere depositing  $\text{CO}_2$  into parts of the cold ocean. When the  $\text{CO}_2$  mixes with the  $\text{H}_2\text{O}$ , an acid is formed, then breaks into ions, causing the ocean to acidify.

20

atmosphere

↓  $\text{CO}_2$

cold ocean



X { An increase in atmospheric  $\text{CO}_2$  would cause the atmospheric temperature to increase, and more  $\text{CO}_2$  to be deposited in the ocean, causing higher ocean acidification.

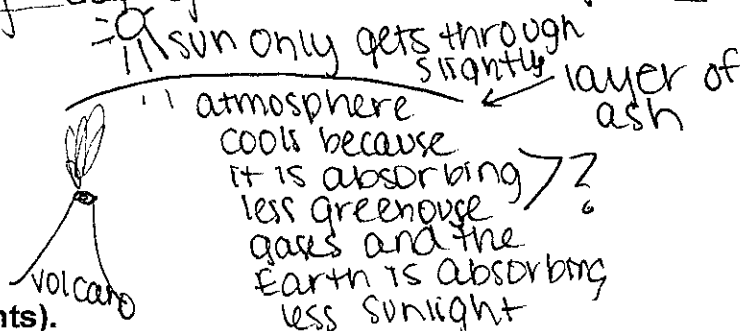
The ~~negative~~<sup>positive</sup> feedback loop of ocean acidification would be that the more  $\text{CO}_2$  that enters the atmosphere, the warmer it gets, but it also becomes necessary to deposit more into the ocean, warming that also. With the water warmer, less would evaporate, causing less cold water in the atmosphere, and atmospheric temp to increase. The negative would be with less evaporation, there would be more warm water to melt glaciers, eventually causing it then having colder water evaporate, cooling the atmosphere.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

With more volcanic eruption on Earth, the atmospheric temperature would go ~~down~~ down when volcanoes erupt large ash clouds into the atmosphere, it takes years for all the ash to clear. ~~This ash blockade would prevent greenhouse gases inside the atmosphere, making it cooler than the temperature increase caused by the gases, evaporation would increase because the earth would be partially blocked from the sun with increased atmospheric heat, more evaporation would occur, but less cloud formation would happen. With so many trapped gases and evaporation, the temperature would~~ ← changed my mind, sorry.  
With a large portion of the sun's rays blocked from the Earth, less respiration would occur, emitting less greenhouse gases.



Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is different from degassing because during evaporation gas is released

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

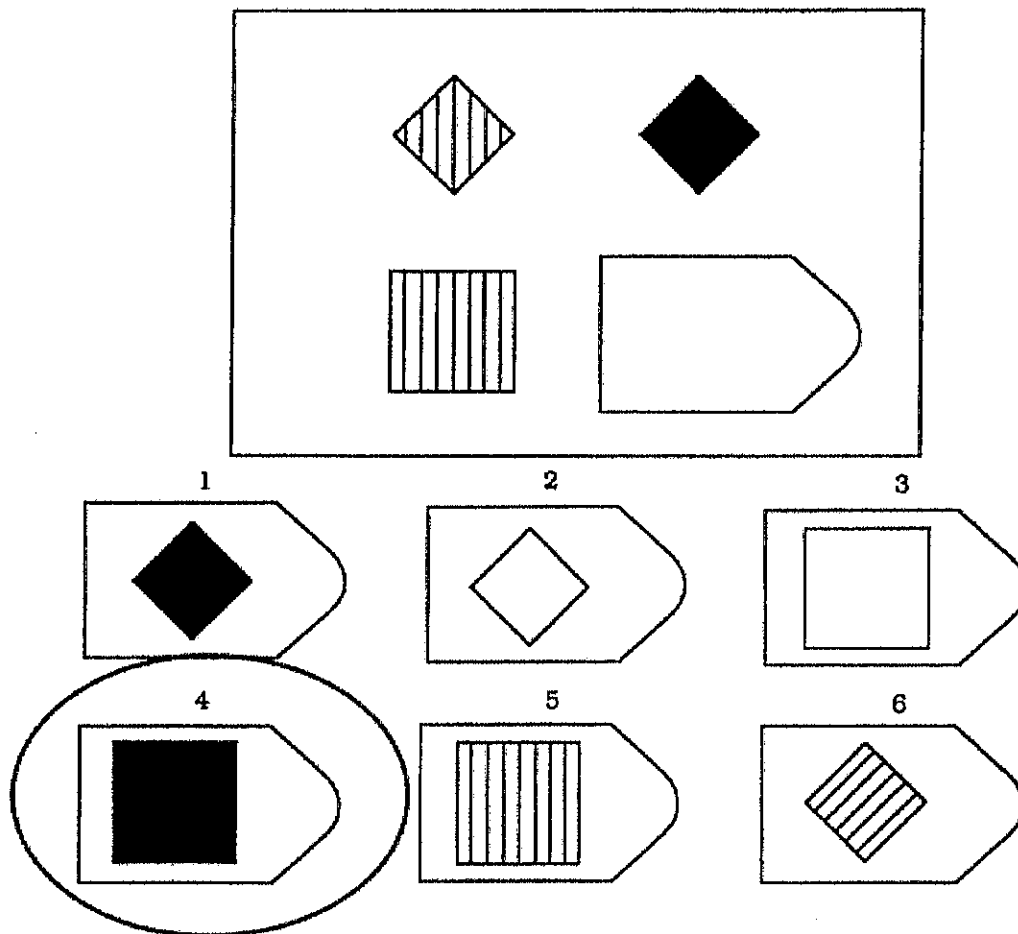




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

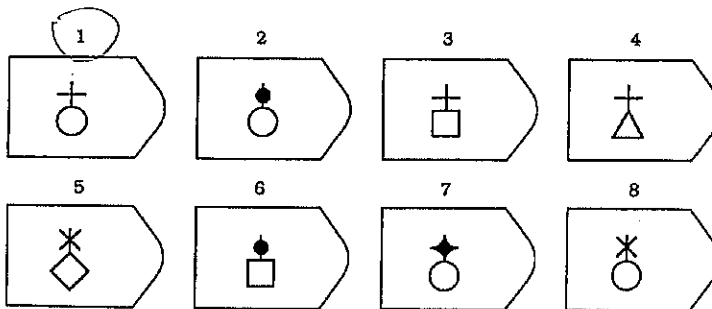
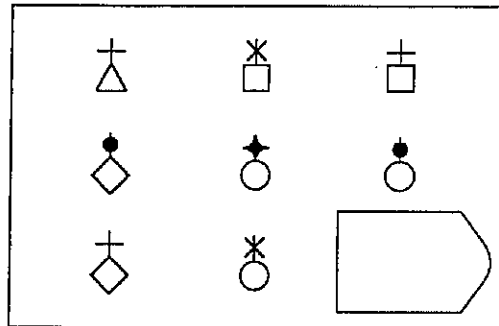


**Answer: 4**

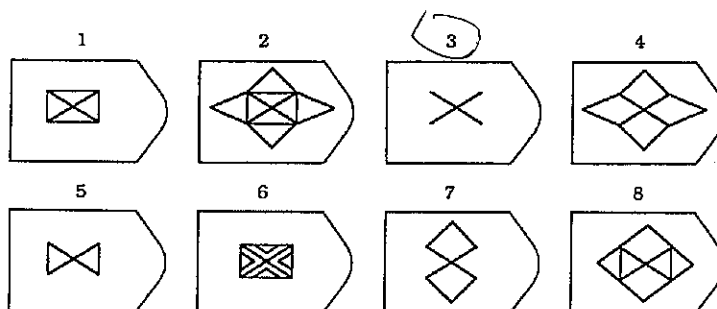
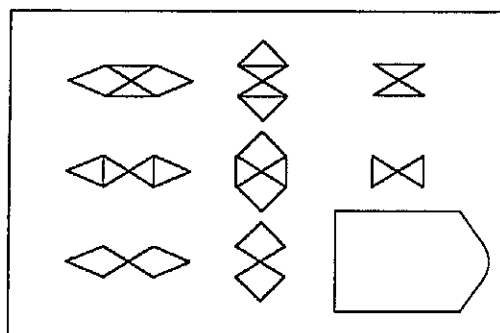
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Please choose the image that best completes each of the following patterns.

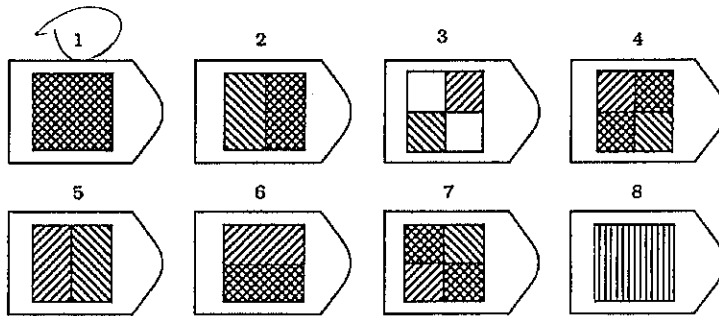
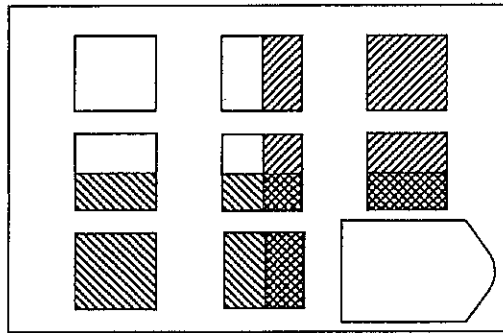
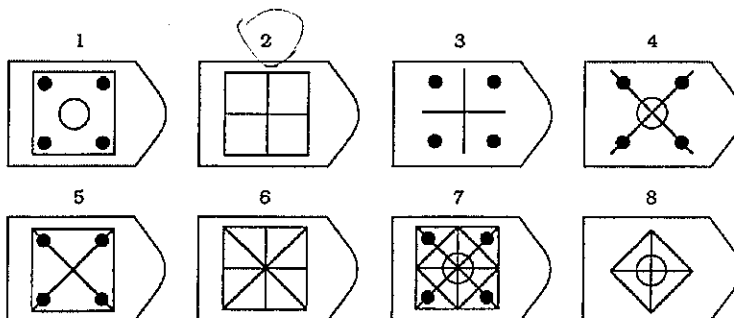
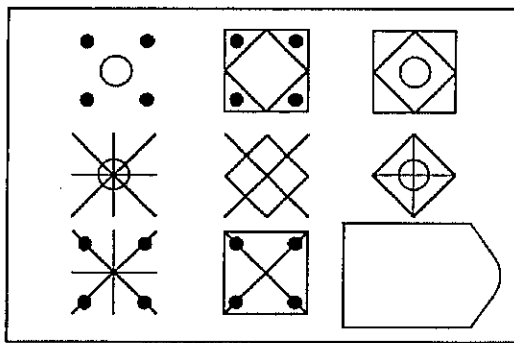
### PATTERN 1



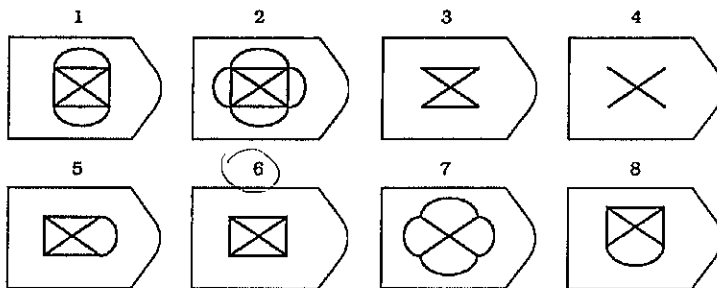
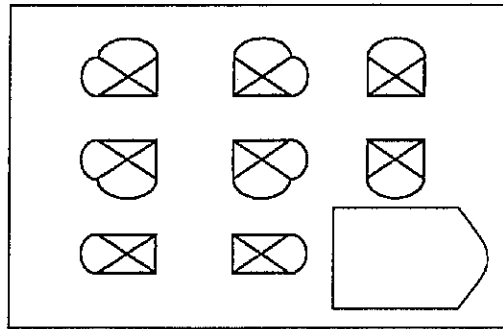
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

B 1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

D 2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

A 3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

C 4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

D

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- A ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.

D

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- ☒ D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48047

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42601752  
Version A

GROUP: T10

87

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- b
1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- d
2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- c
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- ~~a. A= erosion, B= deposition, C= uplift and erosion~~
  - ~~b. A = erosion, B= biochemical precipitation, C= uplift and deposition~~
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- A
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- C
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ~~a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.~~
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- b
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- ☐ a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- ☐ c. The reservoir is growing smaller.
- ☐ d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
- ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- ☒ 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☐ a. The Earth's atmosphere would become colder than it is today.
- ☐ b. The Earth's atmosphere would become warmer than it is today.
- ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
- ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a) Ocean acidification is caused by increased amounts of carbon dioxide in the oceans. With increase amounts of carbon dioxide in the atmosphere cause increased amounts in the ocean. When increased amounts of carbon dioxide enter the ocean it causes the ocean to become more acidic. So if there are increasing amounts of  $\text{CO}_2$  in the atmosphere it would affect the ocean acidification and cause it to increase as well. This is an example of a positive feedback loop because increased  $\text{CO}_2$  in the atmosphere  $\rightarrow$  increased  $\text{CO}_2$  in oceans  $\rightarrow$  more ocean acidification  $\rightarrow$  increased water vapor  $\rightarrow$  increased atmospheric temp  $\rightarrow$  cycle continues. However this can be a negative feedback loop because increased  $\text{CO}_2$  in atmosphere  $\rightarrow$  increased  $\text{CO}_2$  in oceans  $\rightarrow$  increased ocean acidification  $\rightarrow$  lower pH of ocean water  $\rightarrow$  decrease in ocean temperature  $\rightarrow$  decrease in water vapor  $\rightarrow$  slow decrease of atmospheric temperature

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

1) The greenhouse effect is visible energy from the Sun passing through the atmosphere to the Earth's surface because the atmosphere doesn't have the ability to trap visible energy. Once the visible solar energy hits Earth's surface it is either reflected, back into space as visible energy, due to ice cover, or it is absorbed by water, soil, etc. Once it is absorbed it is re-emitted as infrared energy, or heat energy. The infrared energy is then "trapped" by greenhouse gases in the atmosphere. The greenhouse gases get excited and re-emit the infrared energy in different directions. The cycle of being absorbed and re-emitted continues, and stays "trapped" in the atmosphere due to greenhouse gases.

2) This increase in volcanism affects the Earth's atmospheric temperature by decreasing it. With large amounts of ash in the air, ash clouds form. These clouds block solar radiation trying to enter. If the solar radiation was limited by the ash clouds then the greenhouse effect would be thrown off. Without solar radiation the amount absorbed by the Earth's surface would decrease which would cause a decrease in infrared energy being emitted. With lesser amounts of infrared, heat energy the greenhouse gases don't trap and re-emit "as much so the atmospheric temperature would decrease."

25

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

2 evaporation is the change from a liquid to gas. degassing is gas being released from a liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

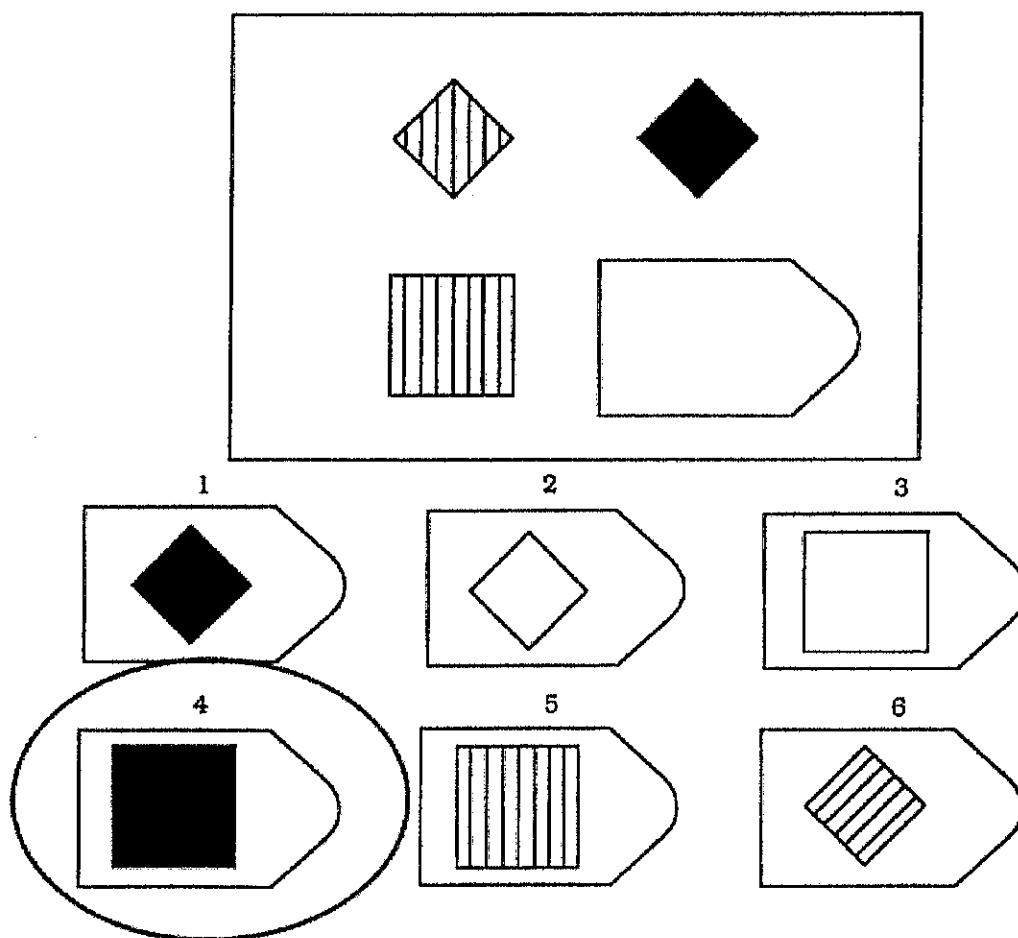
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

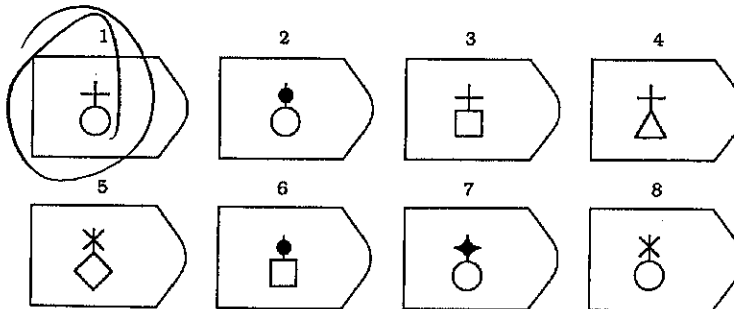
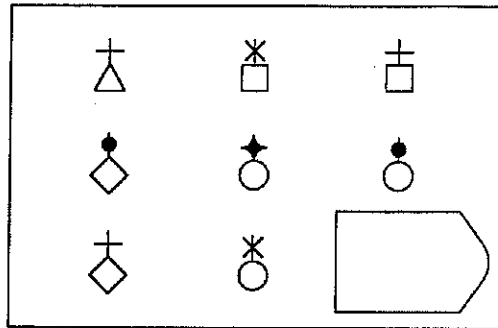


**Answer: 4**

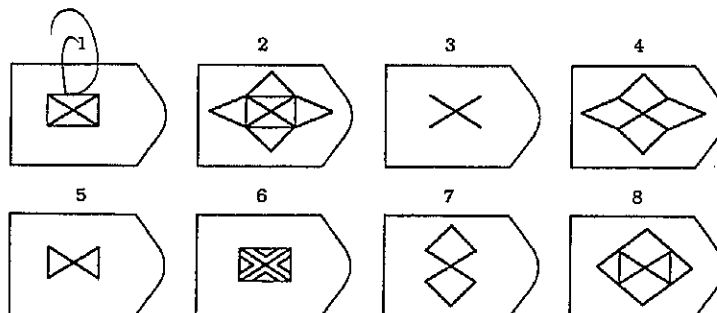
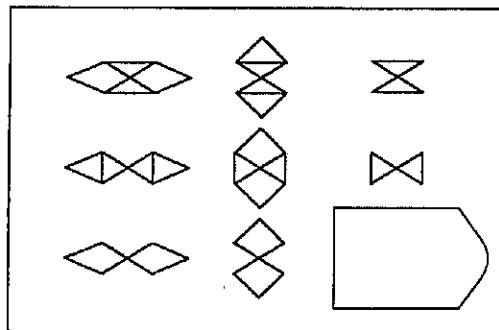
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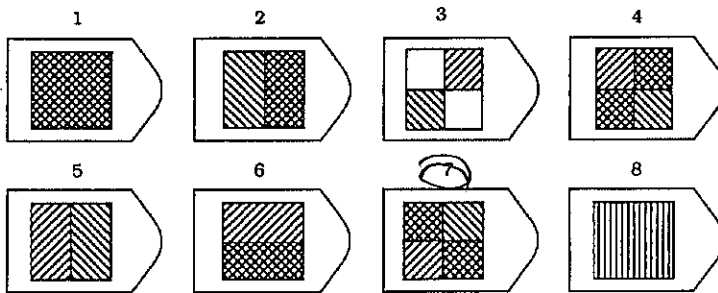
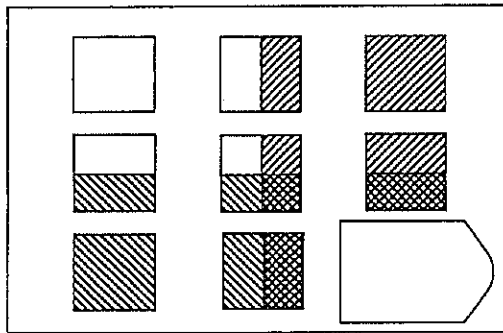
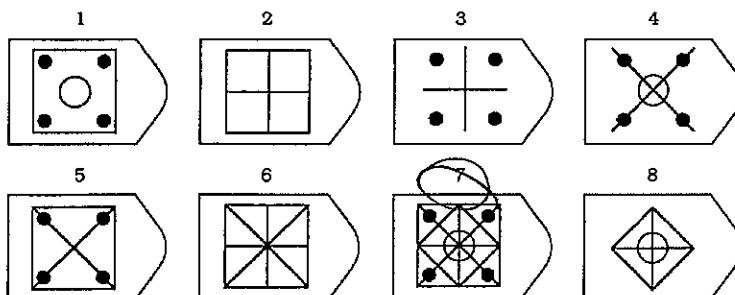
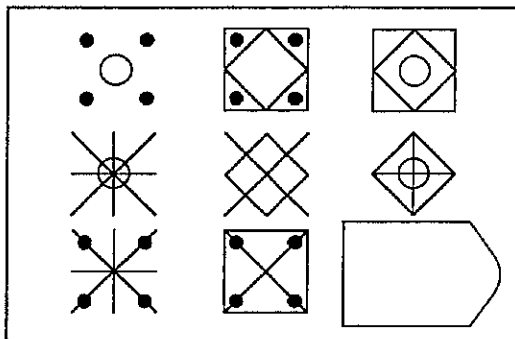
Please choose the image that best completes each of the following patterns.

### PATTERN 1

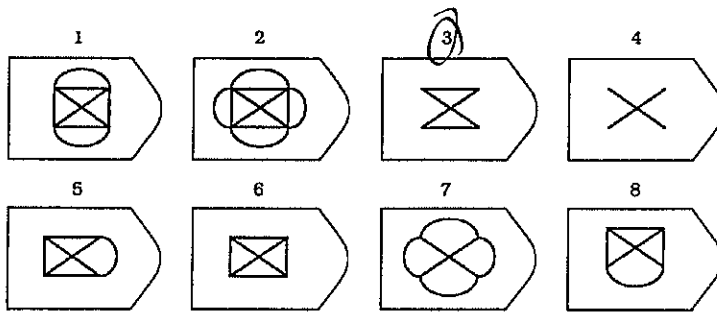
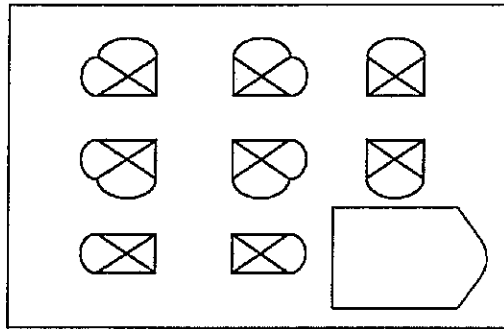


### PATTERN 2



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.
  - A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
  - ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
  - A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
  
3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.
  - ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
  
4. The rival gangs used graffiti to define their territorial boundaries.
  - A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - ☒ C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 60062

What is your gender?

☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A4106 9790  
Version A

GROUP: T10

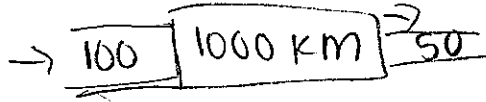
49

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - ~~a.~~ The magma becoming colder
  - b. Gas bubbles forming in the magma
  - ☒ c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ~~d.~~ An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - ~~a.~~ A= erosion, B= deposition, C= uplift and erosion
  - ~~b.~~ A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
  - ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.



8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- ☒ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- ☒ a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is when the ocean water becomes acidic. This occurs when oceans absorb carbon dioxide from the atmosphere. The oceans absorb  $\text{CO}_2$  from the atmosphere if the atmospheric temperature is warmer than the ocean water. Once  $\text{CO}_2$  is absorbed into the oceans it mixes with the salt water making an acidic solution. An increase in atmospheric carbon dioxide will result in an increase in  $\text{CO}_2$  in the oceans as well because more  $\text{CO}_2$  would be absorbed by them. This would make the oceans even more acidic. A positive feedback loop of ocean acidification is that an increase in  $\text{CO}_2$  in the atmosphere causes an increase of  $\text{CO}_2$  in the oceans resulting in an increase in ocean acidification. A negative feedback loop of this process is that the oceans have to decrease in temp. while the surrounding atmospheric temperature increases in order for the oceans to absorb  $\text{CO}_2$  and ocean acidification to occur.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

Volcanos form when two plates converge and the denser plate subducts under the less dense plate, this usually occurs at a mid-atlantic ridge. When this happens the denser plate pushes down far into the ocean floor (where the temp. and water is warmer) causing portions of the athenosphere to melt. The melted molten rock then rises up through the lithosphere and can eventually erupt through a fracture in the Earth's surface causing a volcanic eruption. Volcanism occurs more regularly when the solar energy (in the form of heat) is emitted from the sun. This energy and UV light can go into the ground making the Earth's surface and under Earth's surface hotter, allowing more melting and volcanism. This energy can also be released through volcanos and form large ash clouds. An increase in the large ash clouds could also cause an increase in atmospheric temperature because the clouds trap in and block solar energy and heat from escaping into space. Thus, with more volcanic activity, more ash clouds are formed, which block in atmospheric heat. The increase of trapped solar energy and  $\text{CO}_2$  in the atmosphere from clouds is what is causing Earth's atmospheric temperature to increase. This is referred to as the greenhouse effect.

1

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

In both processes, liquid changes into a gaseous state and rises. Energy is also being used in both.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

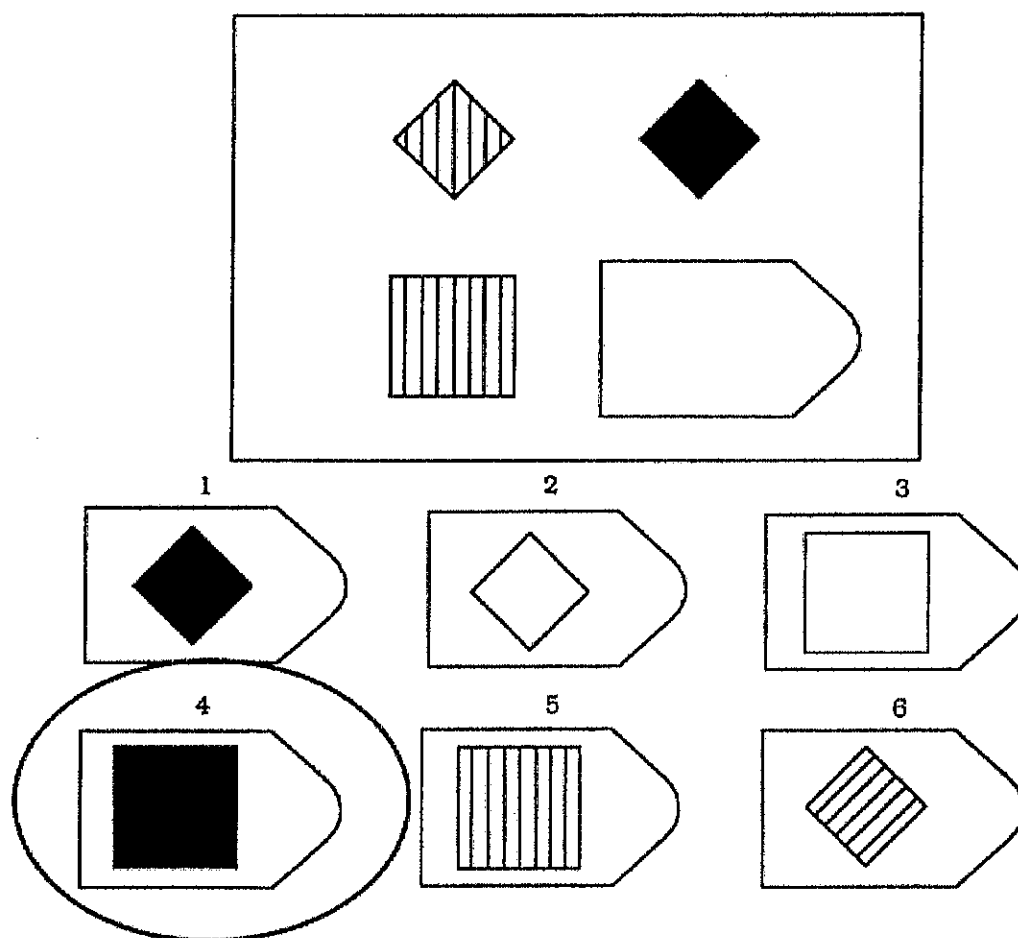




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

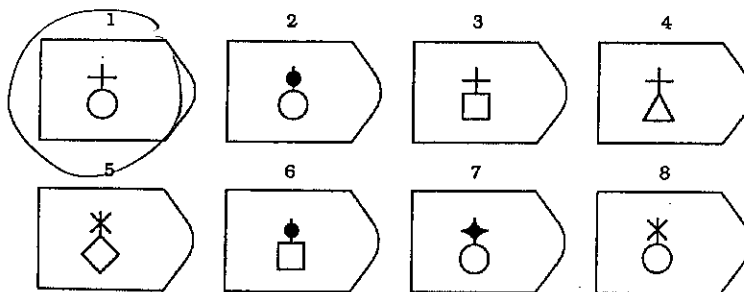
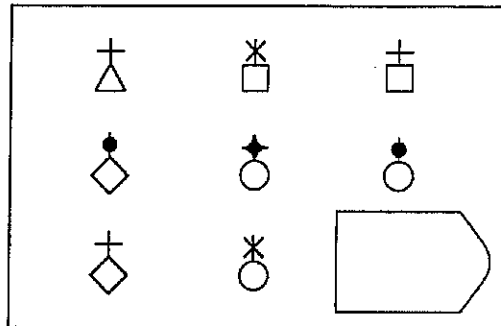


**Answer: 4**

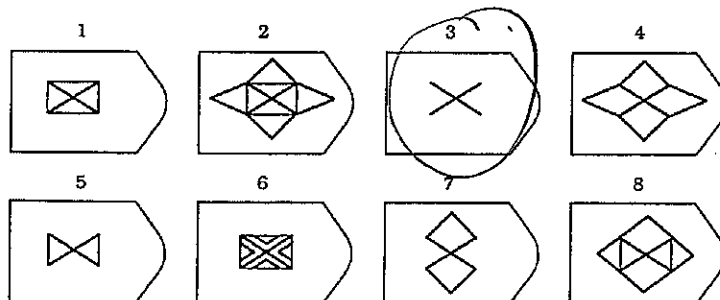
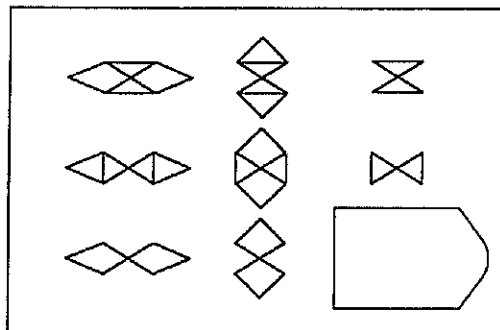
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Please choose the image that best completes each of the following patterns.

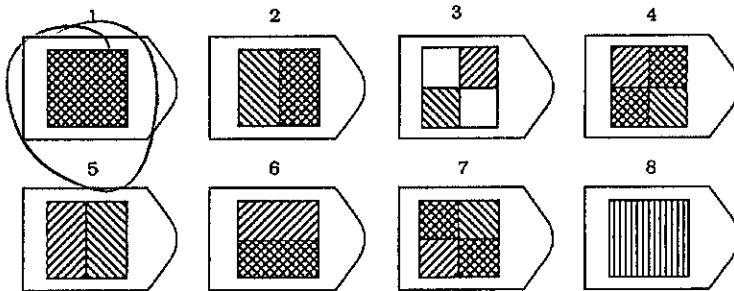
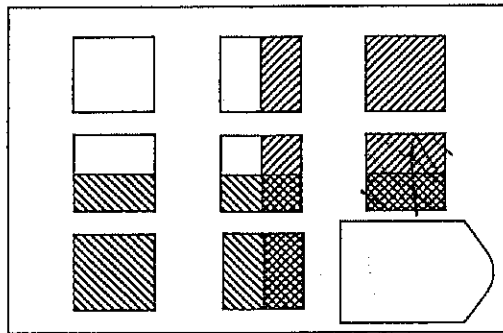
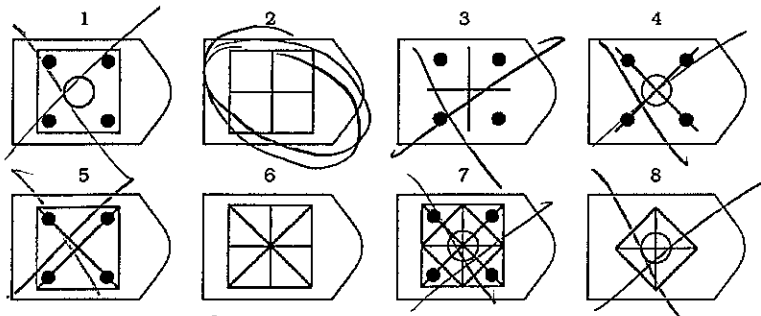
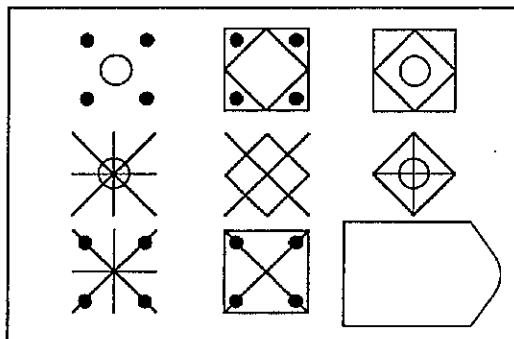
### PATTERN 1



### PATTERN 2



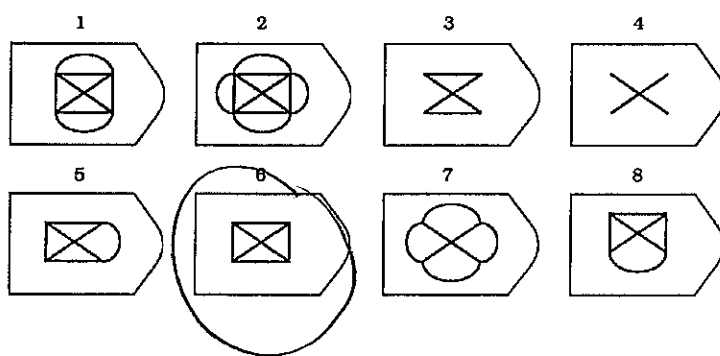
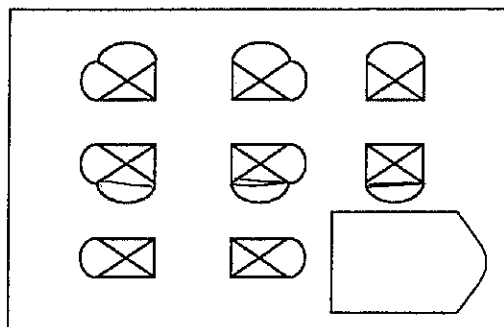
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**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

A41069790

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

☒ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

☒ D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

A. The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

☒ D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - ☒ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - ☒ B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48324

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

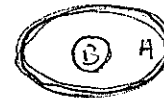
STUDENT NAME: A40461394  
Version B

GROUP: T11

49

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- B** 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b** Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- d** 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d** Crystals forming in the magma
- C** 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= ~~uplift~~ and erosion
  - b. A = erosion, B= biochemical precipitation, C= ~~uplift~~ and deposition
  - c** A= dissolution, B= biochemical precipitation, C= ~~uplift~~ and erosion
  - d. A = dissolution, B= deposition, C= ~~uplift~~ and deposition
- B** 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b** Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- d** 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d** More information about Reservoir A and Reservoir B is needed.
- A** \* 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a** An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.



B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.



~~B~~ 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- ☒ b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

C 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- ☒ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

~~B~~ 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Water is important because it absorbs things, like ions and acids. The more saturated water becomes, the things it absorbs will eventually stop being able to float/dilute into the water and they will sink to the bottom. But molecules never stop moving so they are always circulating. It is important to note that cold water can absorb more foreign molecules than hot water (because when molecules are hot they move so fast) so the colder the oceans are the more they are able to absorb and ~~saturate~~ dilute. However when there is an increase of  $\text{CO}_2$  in the atmosphere and infrared heat gets trapped in a loop - heating up the oceans - the acid can more easily saturate the ocean and become the heavy overwhelming component. The hotter the Earth gets - because of  $\text{CO}_2$  levels and the greenhouse effect - the more acidic our oceans become. ~~There is~~ a negative feedback loop because the evaporation of acidic water  $\rightarrow$  precipitation would only get trapped, become warmer and cause acid rain - making the oceans more acidic.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

18

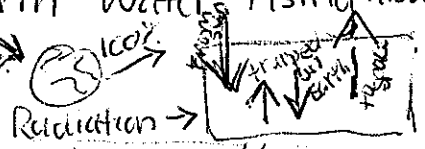
- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If all the volcanoes - at an increase rate/level - erupted on Earth and left large ash clouds in the Earth's inner atmosphere than that would prevent the Sun's radiation - or drastically lessen it depending on the increase of volcanic action - from reaching the earth therefore making the Earth much colder, preventing photosynthesis and other processes which contribute to the creation of greenhouse effect & which would drastically slow down. Not stop though because there is so much infrared radiation trapped on Earth already by the gasses that couldn't make it back out into the atmosphere.

The greenhouse effect is when the sun gives off radiation and the Earth absorbs some, reflecting other into the atmosphere, because ~~the~~ all radiation can't be absorbed by the earth's surface and the greenhouse gasses are excited they absorb it and turn it into infrared radiation then release back towards the earth some towards space. This new radiation gets into a cycle with the convection of earth causing earth to heat up because it is trapped. The radiation comes in by the equator and is pushed by the poles in a cycle ~~of~~ similar to warm water rising then over it was discovered that the earth is in equilibrium.

Extra credit (2 points).

How are evaporation and degassing similar and/or different? They both take molecules out - kind of - ~~and~~ make something smaller, lighter. - less dense. They deal with different processes, ~~they~~ one ~~one~~ is turn water to air - kind of - the other gas to air - kind of - .



A40461394

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

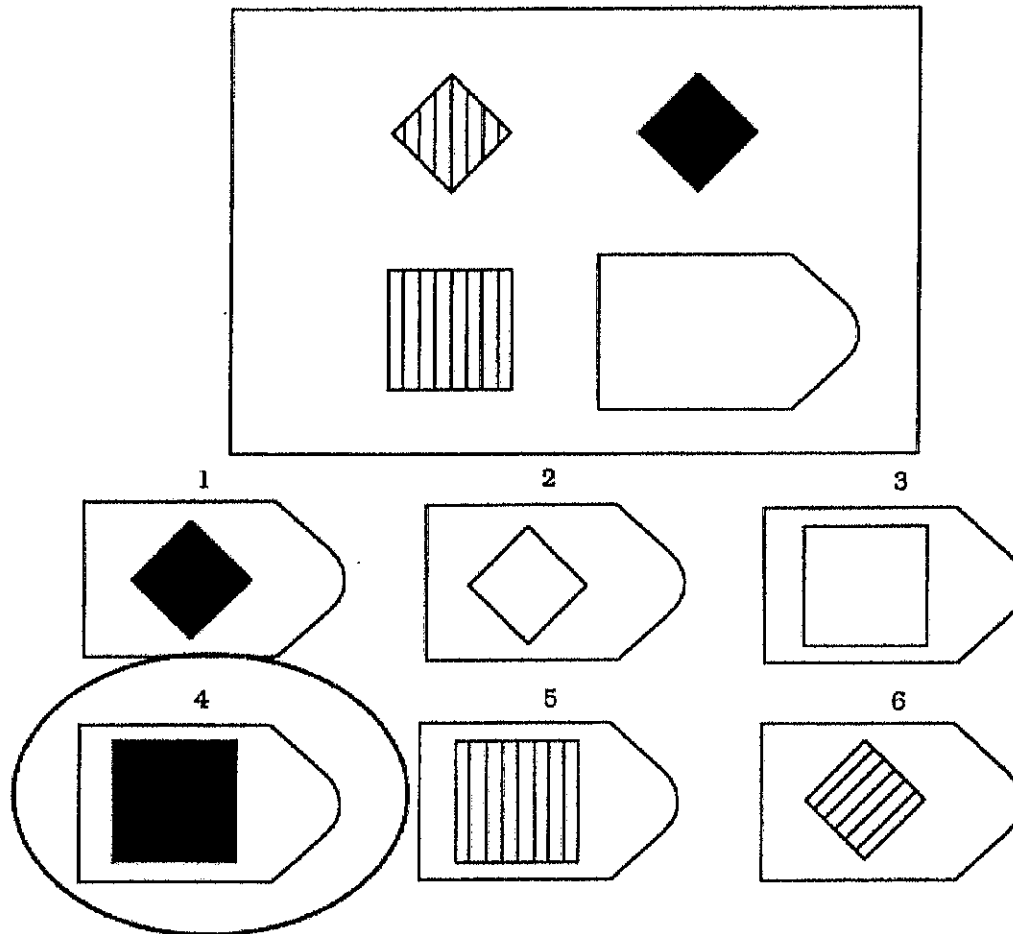
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

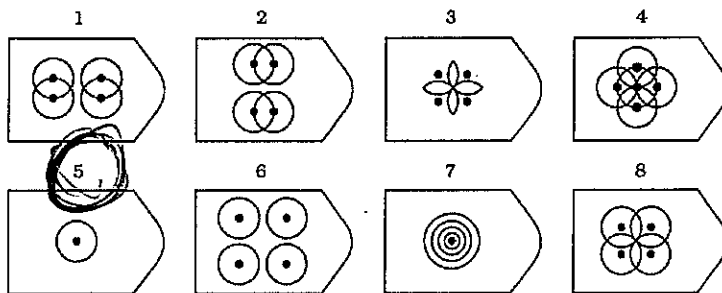
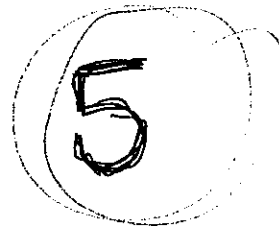
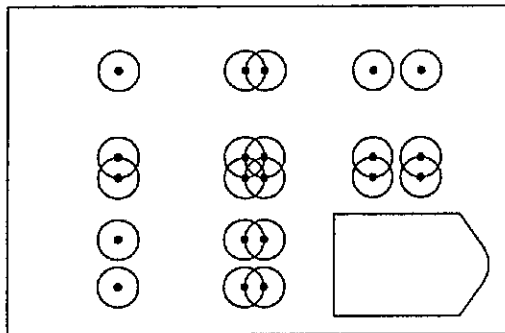


**Answer: 4**

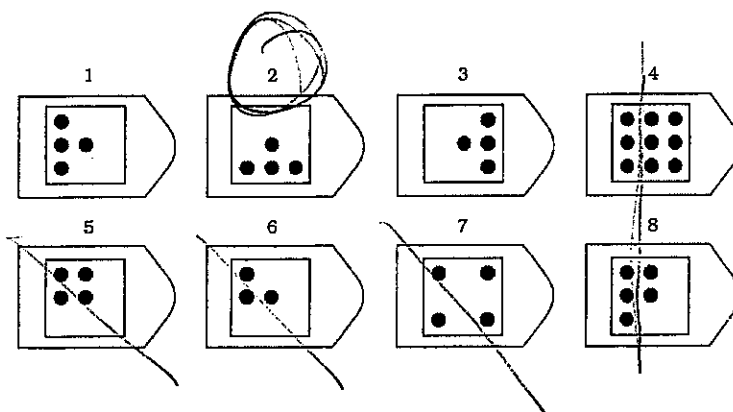
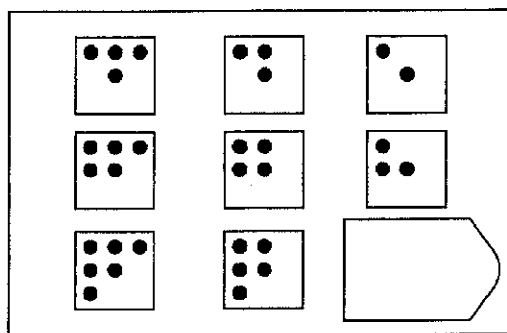
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Please choose the image that best completes each of the following patterns.

### PATTERN 1

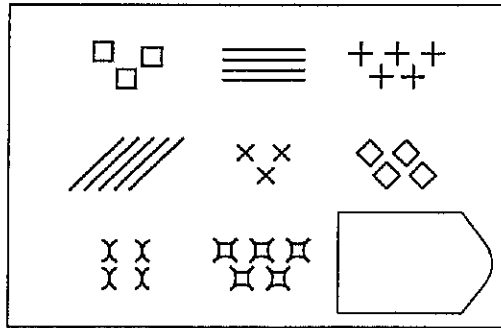


### PATTERN 2

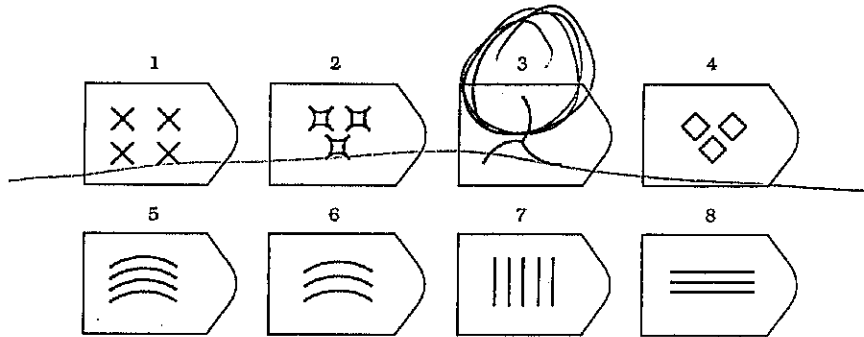


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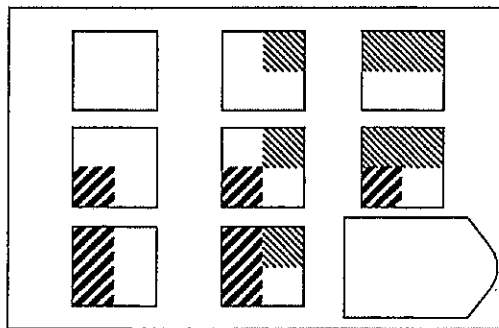
## PATTERN 3



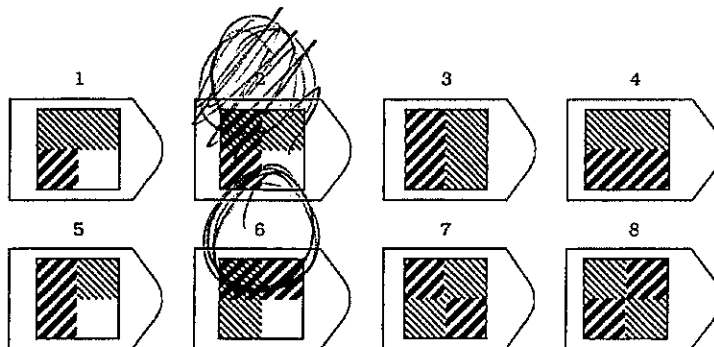
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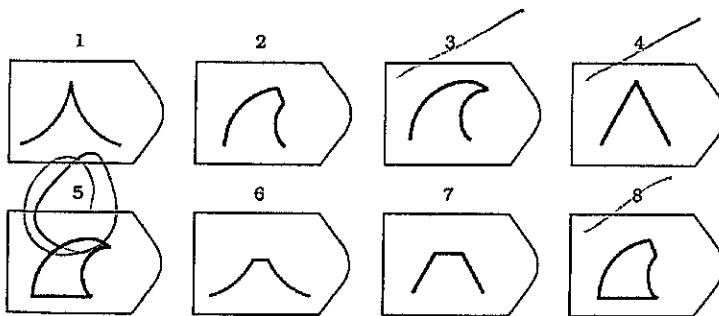
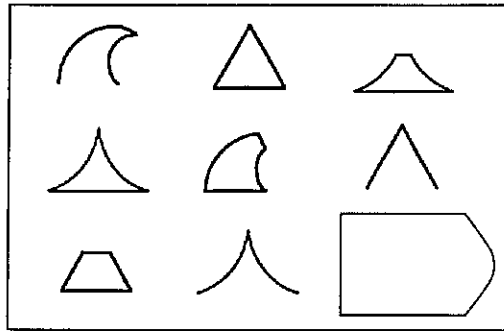


## PATTERN 4



6



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

d 1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

~~A.~~ While debugging their broken firewall, a programmer came across top-secret CIA files.

~~B.~~ As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

~~C.~~ After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

☒ D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

A 2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

d 3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

~~A.~~ Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.

B. Bob was able to maximize his work time by cutting back on watching TV during the day.

☒ C. Sean has been closely monitoring his eating in an attempt to improve his diet.

~~D.~~ Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

C 4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

~~A.~~ After eating a big lunch, Dan went back to his office and took a nap.

B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

A

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

C

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- ~~B. Hitting your head. They both involve something that causes headaches.~~
- ☒ C. Being sleep deprived. They both involve impaired functions.
- ~~D. Eating too much candy. They both involve lack of self-control.~~
- ~~E. Sleeping late. They are both caused by lack of self-control.~~

C

2. Water freezing is like...

- ~~A. Dew forming. They are similar because they both involve a drop in temperature.~~
- ~~B. Blowing up a balloon. They are similar because they both involve becoming less dense.~~
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- ~~D. Building a house. They are similar because they both involve building a structure.~~

### DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48301

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42627086  
Version B

GROUP: T11

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- ☒ 8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- ☒ 9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- ☒ 10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in carbon dioxide would affect ocean acidification because more  $\text{CO}_2$  in the atmosphere would cause less clouds which would cause more water to evaporate into the atmosphere creating more clouds that way which would effect the oceans temperature how?

Not sure if this is the right process!  
I wrote what I remembered talking a little about w/ positive & negative feedback

how?

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanism that erupt a large ash cloud would affect the earth's atmospheric temperature because there would be a "the volcanic ash" is making it harder for the heat to make it into the atmosphere or it will block what is already in the atmosphere

1

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

evaporation & degassing are similar because they both deal w/ gas or water evaporating into something else

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

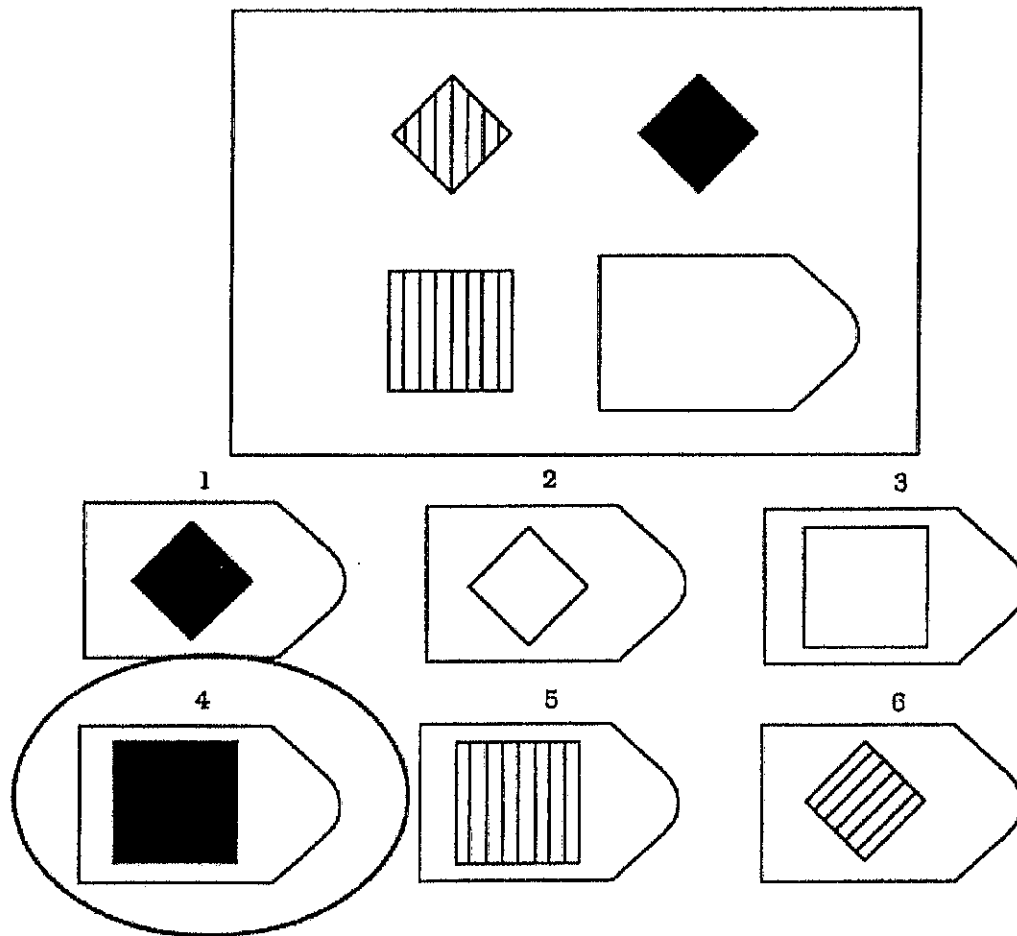




# Analogical Assessment

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*Example*

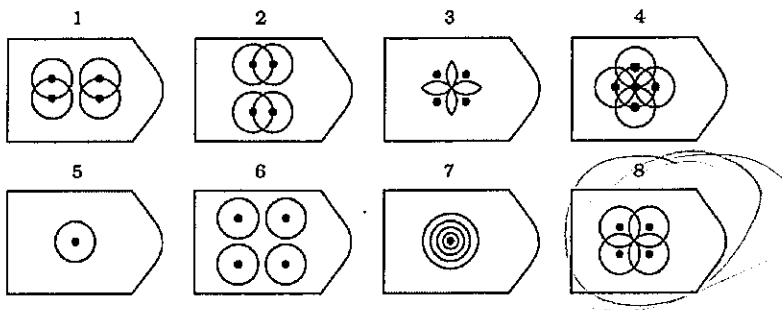
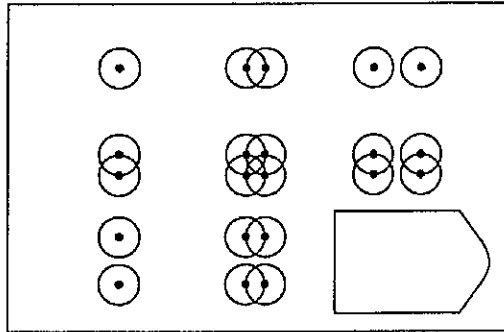


**Answer: 4**

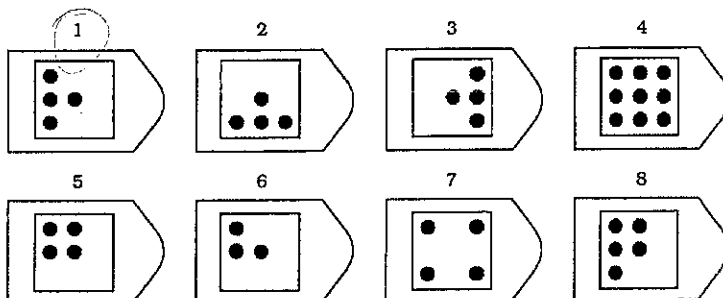
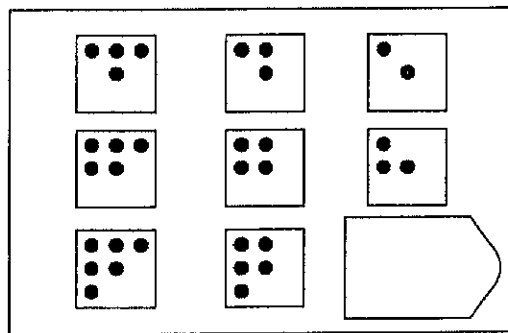
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

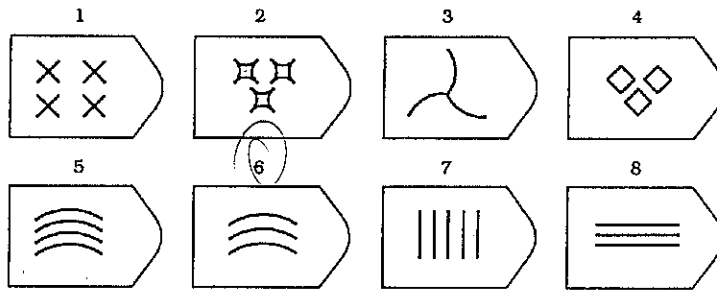
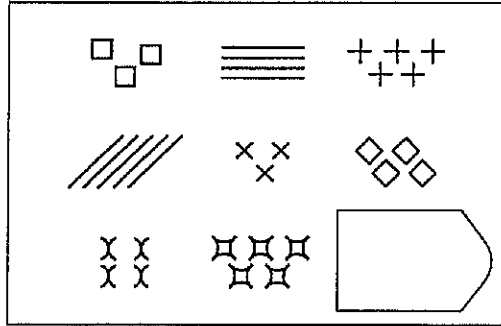
### PATTERN 1



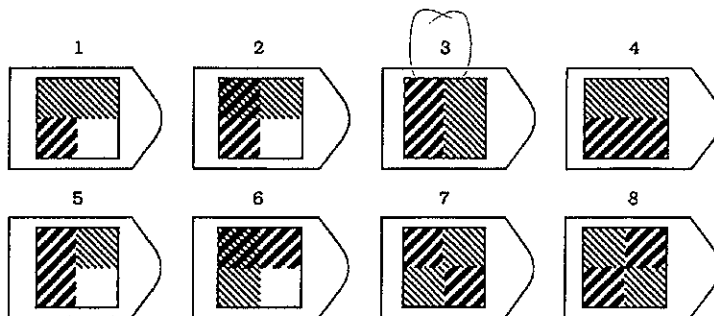
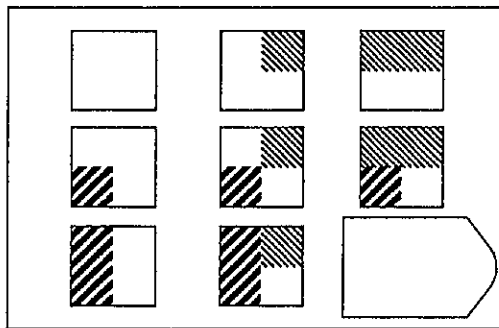
### PATTERN 2

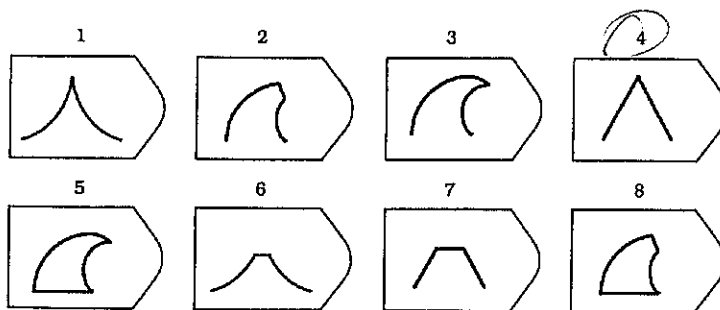
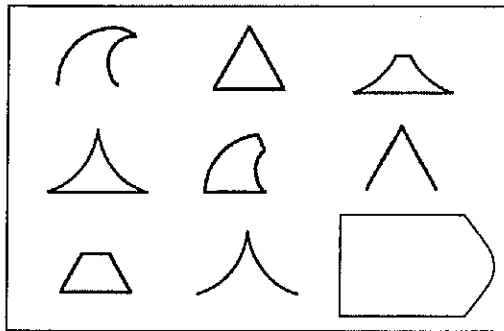


## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

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- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
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- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- ☒ B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48023

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A43682453  
Version B

GROUP

T11

72

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- D 1. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ An increase in desert formation resulting in more dusting blowing into the atmosphere
- B 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- C ~~a. A= erosion, B= deposition, C= uplift and erosion~~  
~~b. A= erosion, B= biochemical precipitation, C= uplift and deposition~~  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion C  
d. A = dissolution, B= deposition, C= uplift and deposition
- A 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- A ☒ a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
~~d. More information about Reservoir A and Reservoir B is needed.~~
- C 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ~~a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.~~
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ~~d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.~~

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



## SHORT ANSWER. 25 points each (50 points total)

25

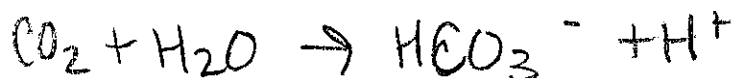
1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a) more  $\text{CO}_2$  in the atmosphere

↓ = more  $\text{CO}_2$   
in the oceans

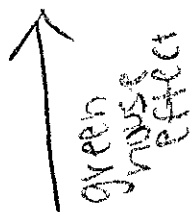


Carbon dioxide + hydron forms

bicarbonate &amp; hydron

b) A positive feed back

100P

Increase  
in tempWater to  
become warmerdecreasing  
its ability  
to hold carbonRelease carbon  
back into  
atmosphere  
causing

A negative feed back

increase in temp  
causes more  $\text{CO}_2$   
in oceanmore  
coral formationdecrease  
in templess  
 $\text{CO}_2$  in  
atmosphereless  
 $\text{CO}_2$  in ocean

A43002453

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

4

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes ~~related to volcanism that influence~~ atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

This increase in earth's volcanism would <sup>20</sup> cause the temperature to decrease because the large ash cloud would be blocking the sun's radiation from being absorbed. However with an ash cloud come many greenhouse gases. These gases would absorb the IR heat that was emitted from the earth. Even though the ash cloud blocks much of sun it can't block all of it. So at first the earth's temperature would decrease because of the ash cloud, but after the cloud was gone the gases would still be in the atmosphere trapping the IR & re-emitting back towards earth increasing earth's temperature.

Extra credit (2 points).

2 How are evaporation and degassing similar and/or different?

Evaporation & degassing are different because evaporation is a liquid becoming a gas, and degassing is a gas being released from a liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

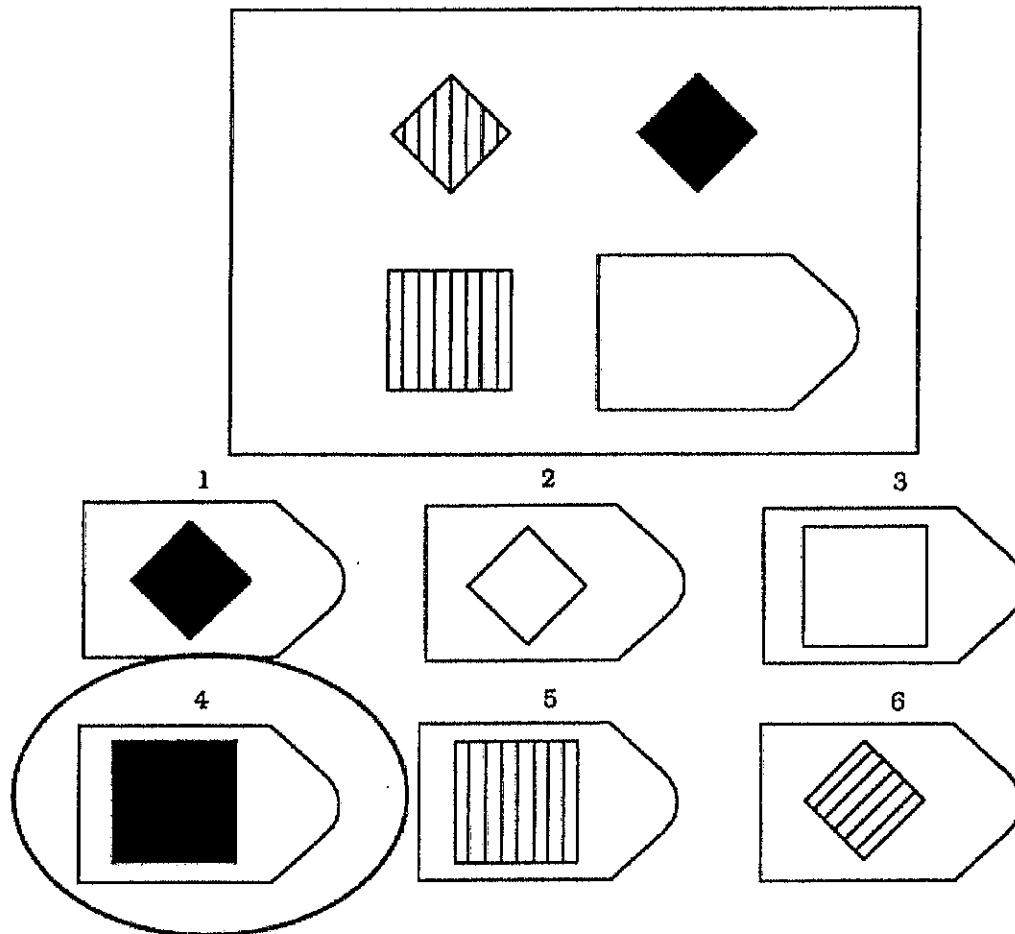
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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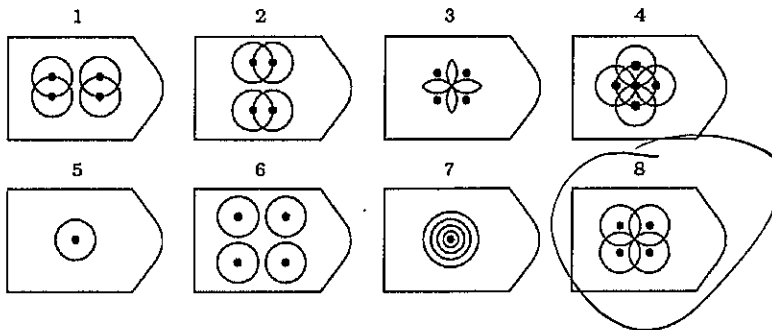
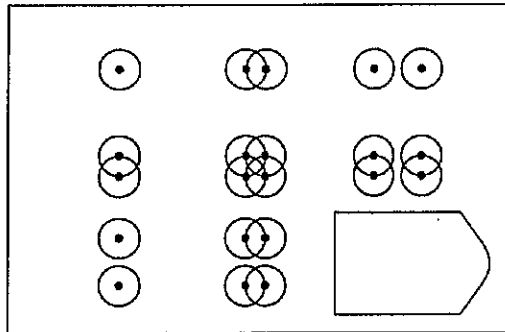


**Answer: 4**

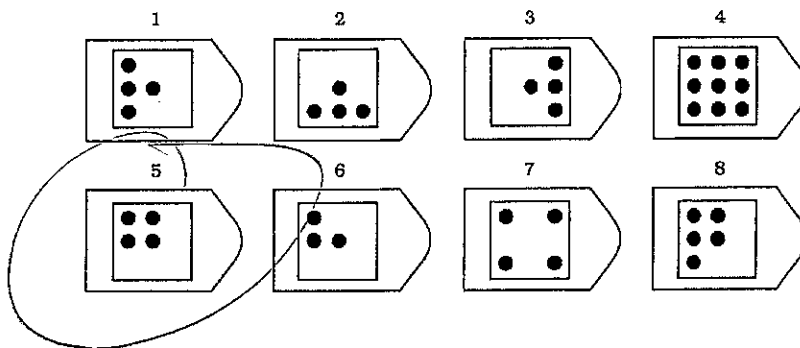
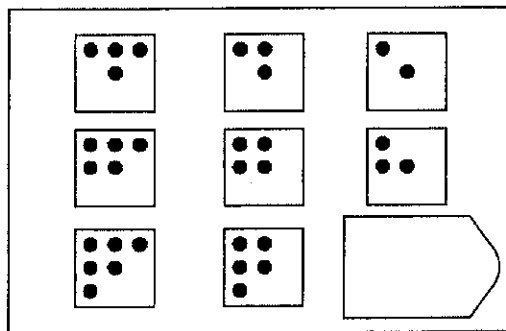
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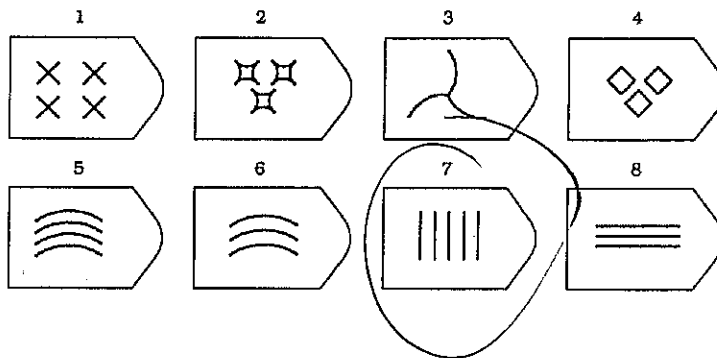
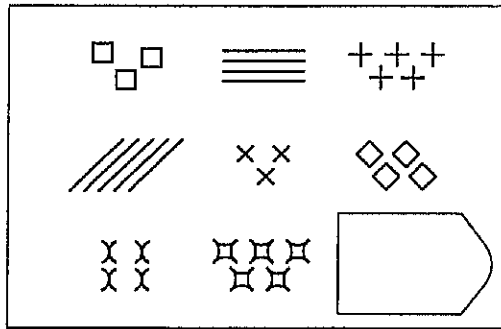
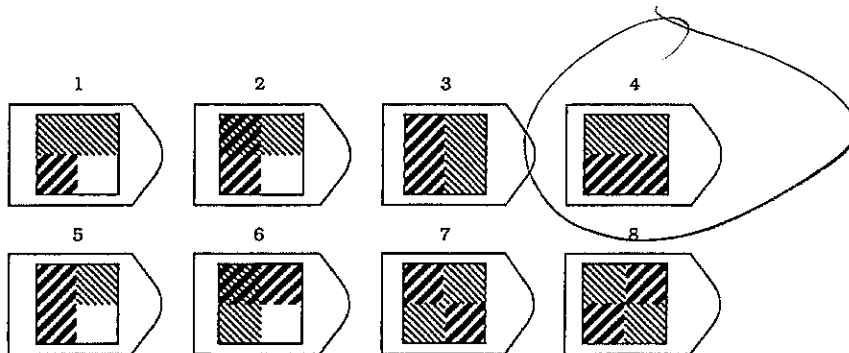
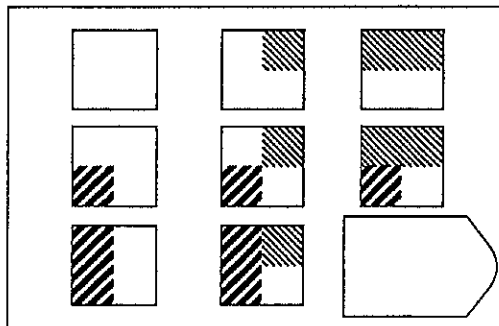
Please choose the image that best completes each of the following patterns.

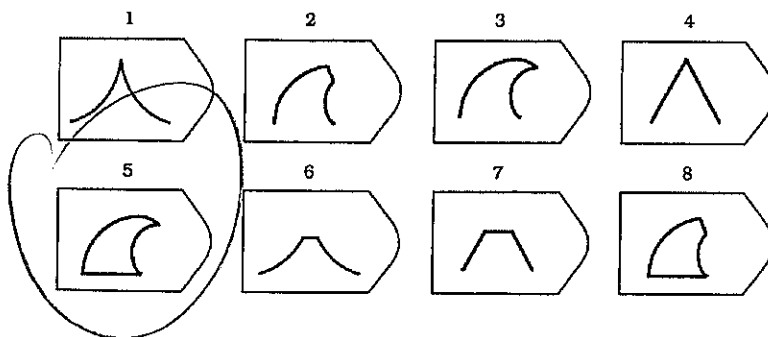
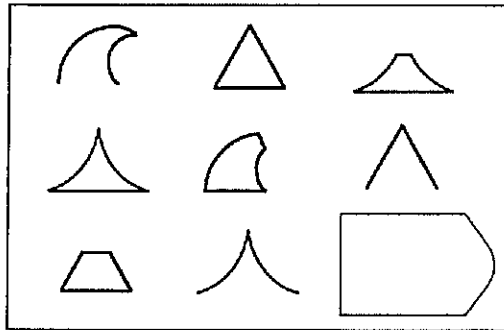
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

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PLEASE CONTINUE ON NEXT PAGE



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- B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
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PLEASE CONTINUE ON NEXT PAGE

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- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- ☐ D. Eating too much candy. They both involve lack of self-control.
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2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
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## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48187

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A43330797  
Version B

GROUP: T11

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
a. ~~Melting of ice sheets resulting in more visible energy from the Sun being absorbed~~  
b. ~~Melting of permafrost resulting in more methane escaping into the atmosphere~~  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. ~~An increase in desert formation resulting in more dusting blowing into the atmosphere~~ (C)
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. ~~The magma becoming colder~~  
b. Gas bubbles forming in the magma  
c. ~~The surrounding crust becoming hotter~~  
d. ~~Crystals forming in the magma~~ (B)
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
b. A= erosion, B= biochemical precipitation, C= uplift and deposition  
c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. ~~A= dissolution, B= deposition, C= uplift and deposition~~ (B)
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. ~~Neither human activities nor natural processes are important causes of the greenhouse effect.~~  
e. ~~The human and natural causes of the greenhouse effect are not understood.~~ (C)
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. ~~Reservoir A has a shorter residence time than Reservoir B.~~  
b. Reservoir B has a shorter residence time than Reservoir A.  $\frac{150}{10} = 5$   $\frac{100}{10} = 10$   
c. ~~Reservoir A and Reservoir B have equal residence times.~~  
d. ~~More information about Reservoir A and Reservoir B is needed.~~ (B)
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun. (A)

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- ~~d. The reservoir's residence time is 10 years.~~

$$\frac{1000}{50} = 20$$

B

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- ☒ b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

B

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- ~~c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase~~
- ~~d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease~~

A

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

A

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the increasing acidity of the ocean caused by  $\text{CO}_2$  entering water. The chemical reaction produces  $\text{H}^+$ , which  $\uparrow$  acidity + lowers the pH of the ocean.

Ocean acidification is inversely related to temperature, because colder water molecules move slower thus it's easier for  $\text{CO}_2$  to enter water when cold rather than when molecules move faster in hotter water. Thus acidity  $\uparrow$  as temperature  $\downarrow$ .

2.) Positive Feedback. As earth gets warmer because of more  $\text{CO}_2$  in atmosphere, less  $\text{CO}_2$  is absorbed in ocean because the ocean will warm as well + molecules will move faster + it will be harder for  $\text{CO}_2$  to enter ocean, thus, there will be more in atmosphere + this means more infrared heat will be absorbed by  $\text{CO}_2$  molecules since it's a greenhouse gas + this heat will be re-radiated back to earth + it will heat it more + heat the oceans more + less  $\text{CO}_2$  will be able to enter the ocean because it's hotter + it continues to loop.

Negative Feedback: Because the earth gets hotter because less  $\text{CO}_2$  goes into ocean because the water is warmer + vibrating faster, more water will evaporate + this will form more clouds by condensation. Clouds reflect 20% of radiation thus this would cause more reflection + this would cool earth because less heat is absorbed. This will then allow water to cool + more  $\text{CO}_2$  to enter + this will increase the acidity + lower pH of ocean.

neg feedback makes changes to bring to equilibrium  
pos feedback makes changes to make more changes in same direction

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

20

More volcanism would release more  $\text{CO}_2$  into the atmosphere, which will increase greenhouse effect. The greenhouse effect is the absorption of infrared heat by  $\text{CO}_2$ , methane, + water vapor. This heat is then re-radiated back to earth where it is absorbed and/or reflected back to atmosphere, where it is again trapped by greenhouse gases. This both ensures that the earth does not overheat or freeze. When the volcano erupts it releases  $\text{CO}_2$  from lithosphere. Thus, this would cause the earth temps to  $\uparrow$  because more  $\text{CO}_2$  would trap IR heat + re-radiate it back to earth which would cause more absorption of heat +  $\uparrow$  temp.

If the cloud is large enough it could block UV + IR electromagnetic rays altogether. In this case the earth would have no heat entering it, + no absorption of heat. This would cause temps to  $\downarrow$  + would cause the oceans to freeze.

Volcanism is caused by increased movement of the plates + more  $\text{CO}_2$  is released due to this.

EXCREDIT

Evaporation changes ~~it~~ from liquid to gas, while degassing causes it to remain a gas in liquid + the gas in atmosphere so it does not go thru phase change. Same because both change the reservoir.

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

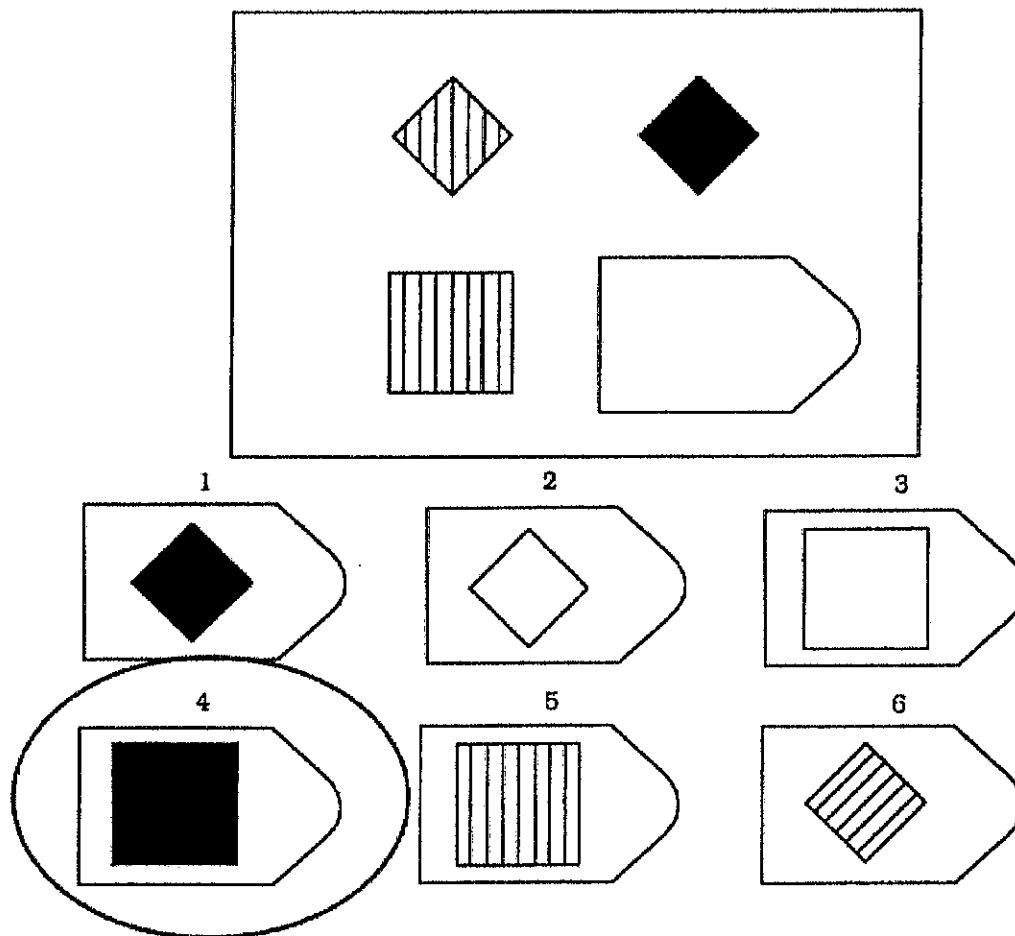




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

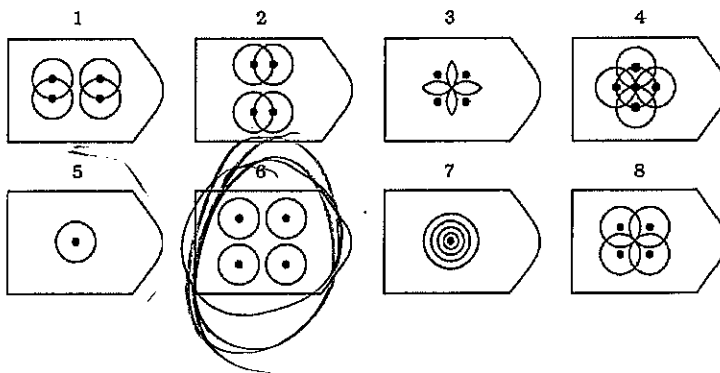
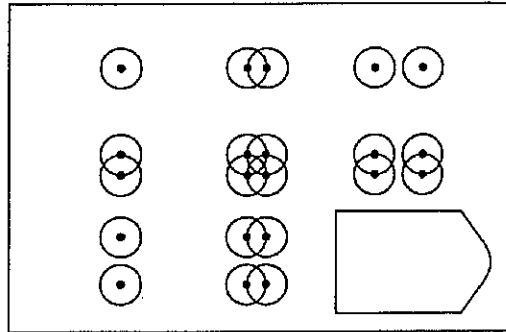


**Answer: 4**

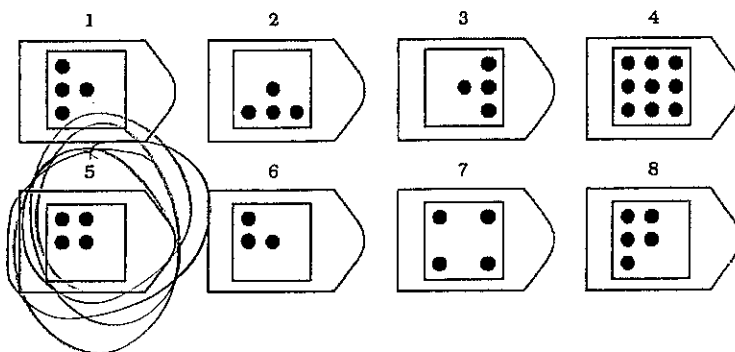
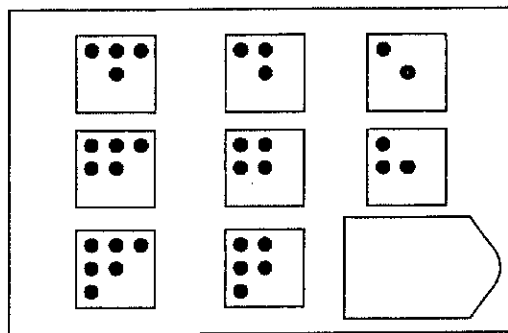
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Please choose the image that best completes each of the following patterns.

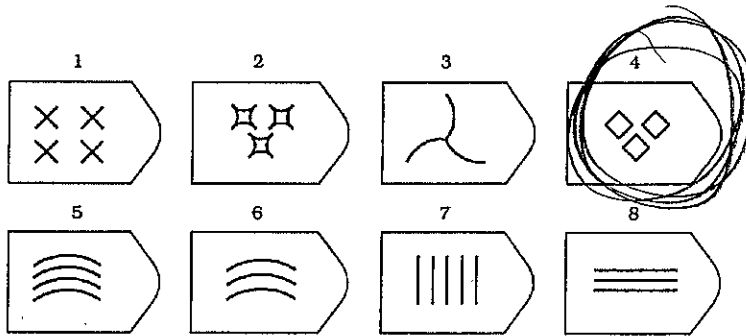
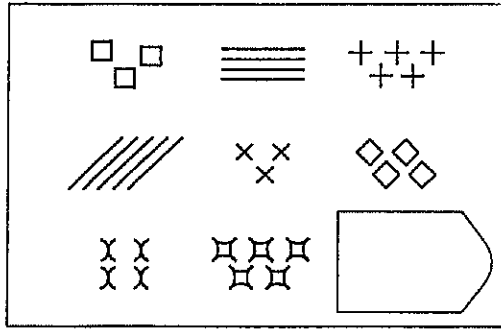
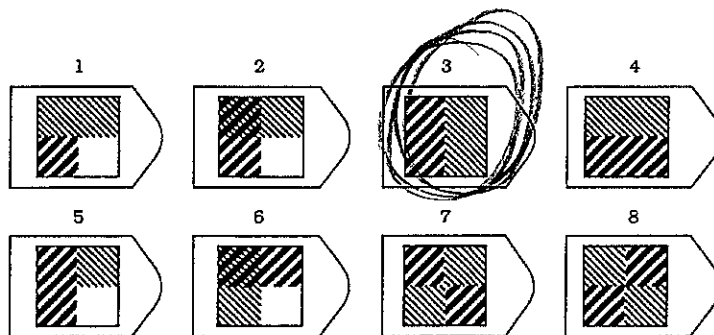
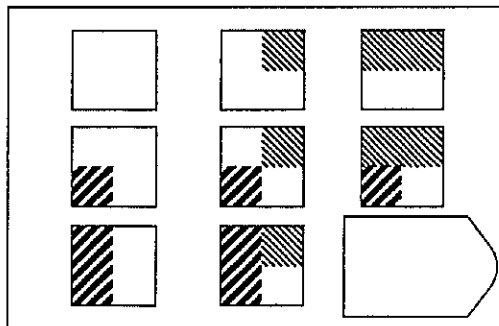
### PATTERN 1

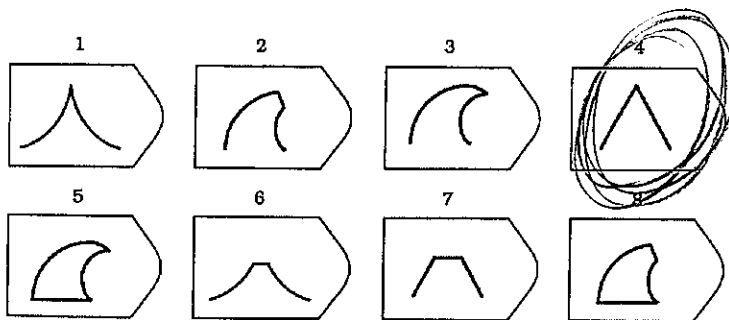
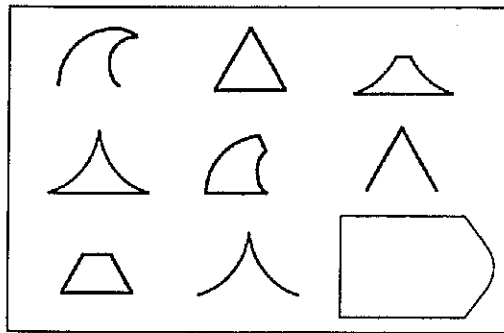


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- ☐ A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- ☐ C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- ☐ D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- ☐ B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- ☐ C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- ☐ D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- ☐ A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- ☐ B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- ☐ C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- ☐ A. After eating a big lunch, Dan went back to his office and took a nap.
- ☐ B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- ☐ D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49441

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42065731  
Version A

GROUP: T12

38

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- B a. The magma becoming colder  
b. Gas bubbles forming in the magma  
C c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- B a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
D B b. Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- C a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
C c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- B a. Human activities are the primary cause of the greenhouse effect.  
B b. Natural processes are the primary cause of the greenhouse effect.  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- A A a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- B a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
D d. More information about Reservoir A and Reservoir B is needed.

B 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- D
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

C 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

B 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would increase the acidity of oceans. The increase of carbon dioxide in the atmosphere would result in more carbon dioxide in the oceans.

When carbon dioxide reacts with water it forms bicarbonate and hydrogen ions, which adds to the acidity of

(ocean acidification) the ocean. The increase of acidity in the ocean portrays a positive feedback loop in regard to the increase in atmospheric  $\text{CO}_2$ . A negative feedback loop that occurs in this situation would be a decrease in the oceanic temperature + ? that results from the formation of carbon dioxide into bicarbonate and hydrogen ions.

~~18~~ 18

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The large ash clouds that erupt as a result of the increase in volcanism would raise the earth's atmospheric temperature. Infrared (heat) rays that are being ~~reflect~~ from the earth's surface would become trapped and continue to be reflected and re-emitted between the earth's surface and ash clouds. Less energy would be reflected into space ~~and~~ as a result of the ash clouds blocking them from leaving the earth's atmosphere. This would result in an increase of the atmospheric temperature.

~~10~~ 10

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are similar because they both can result in the formation of gaseous molecules forming into liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

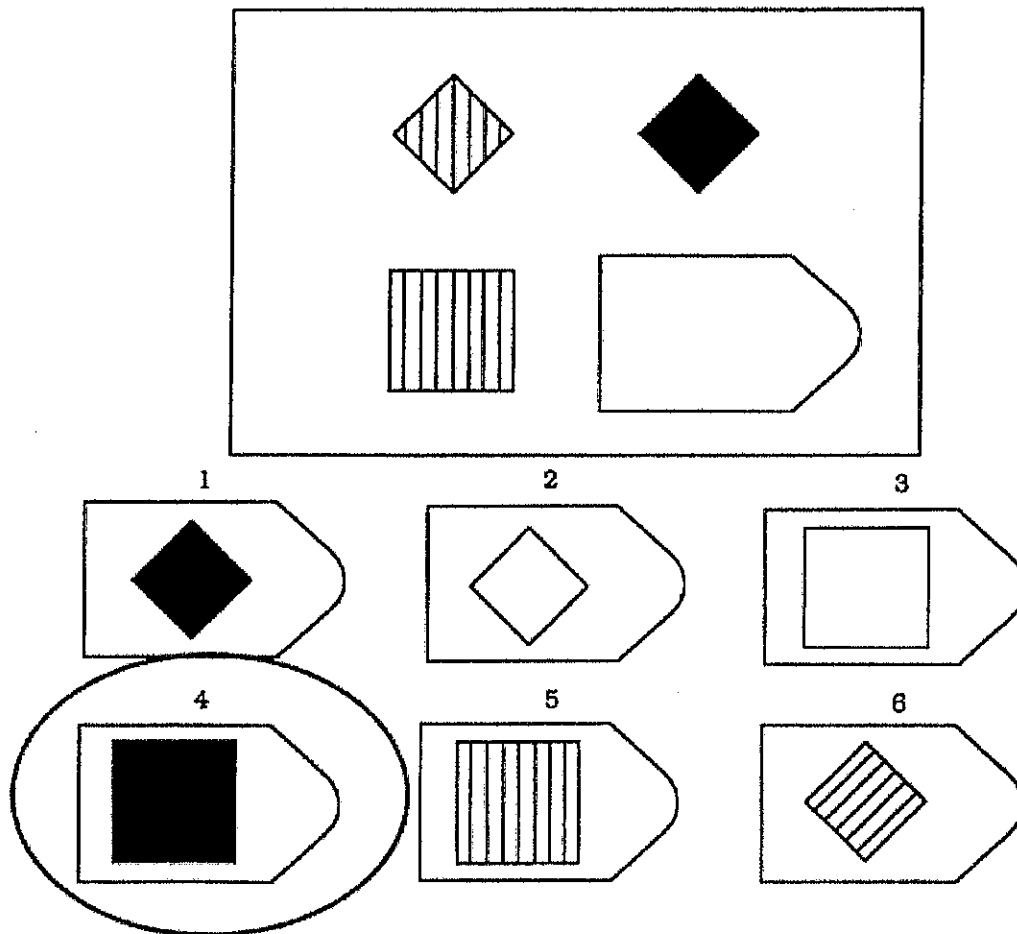
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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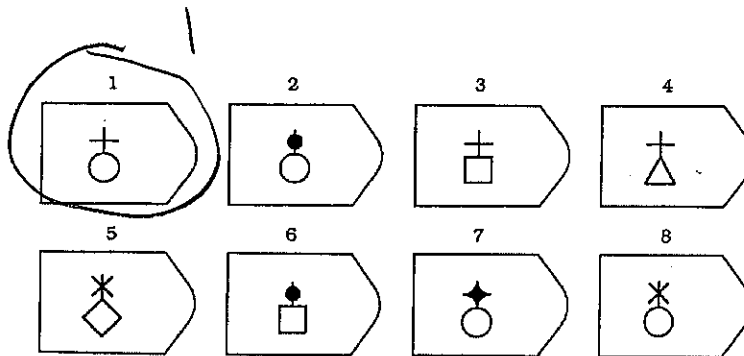
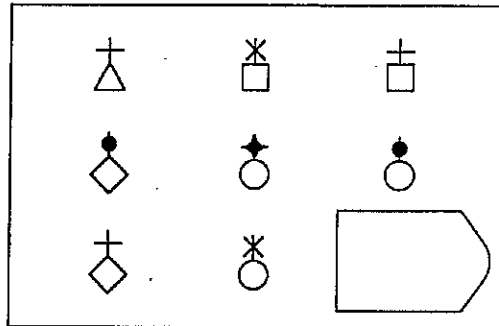


**Answer: 4**

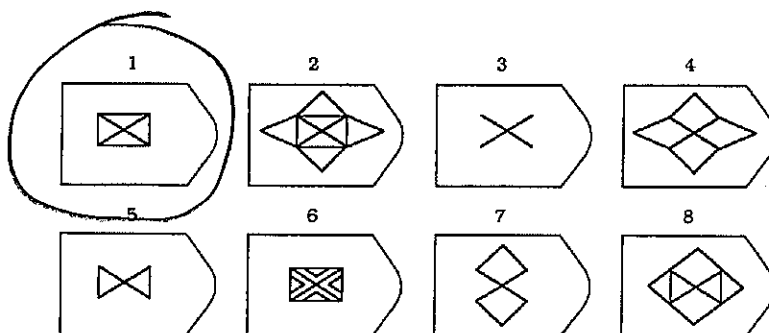
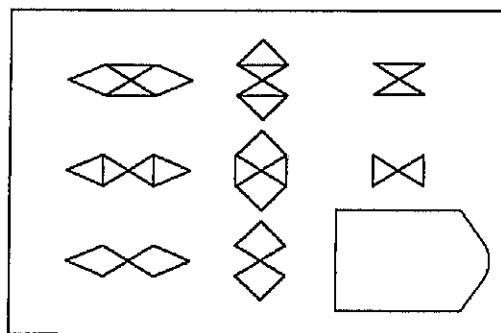
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### PATTERN 1



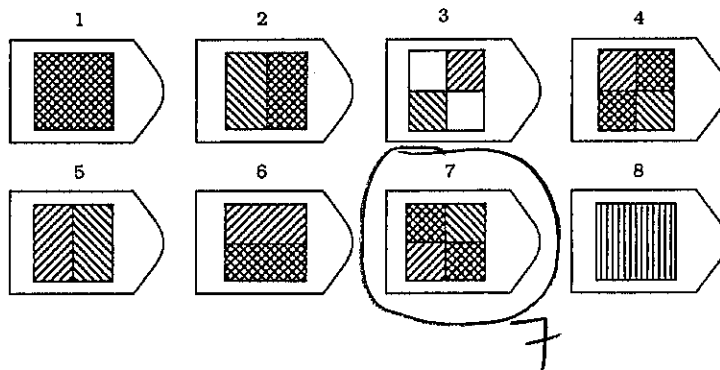
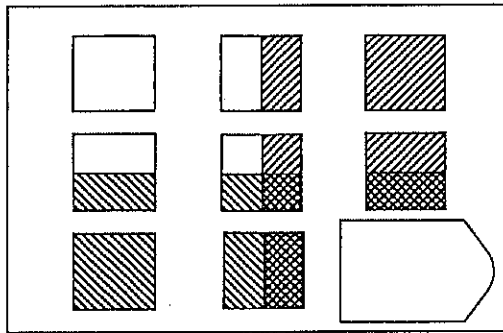
### PATTERN 2



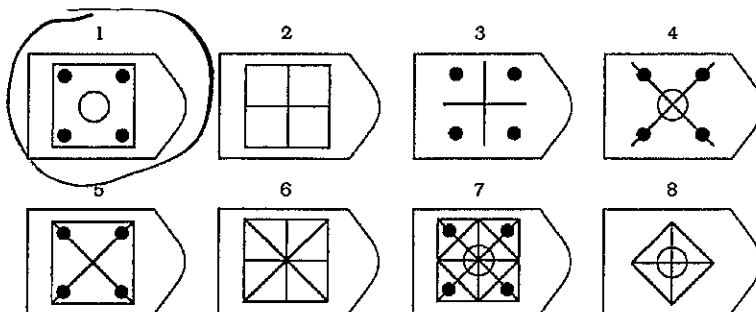
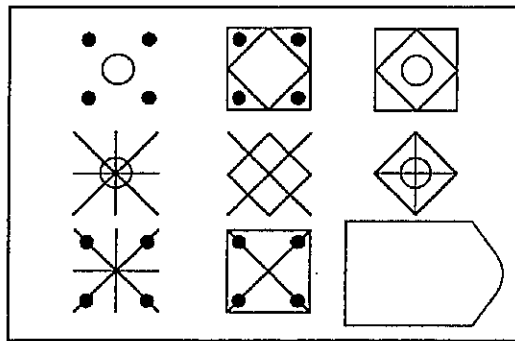
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A42065731

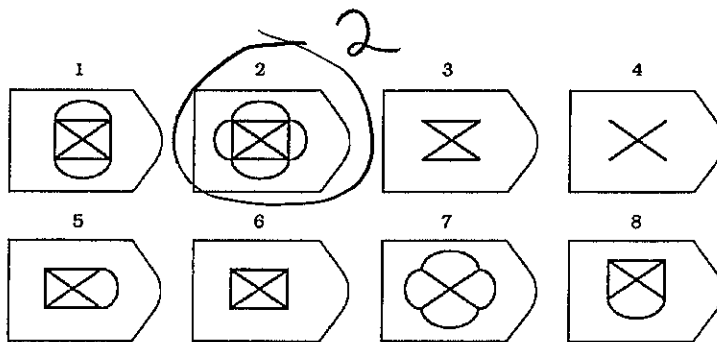
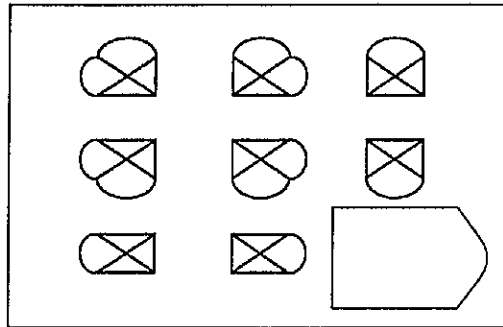
## PATTERN 3



## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- ☒ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48116

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 42204525  
Version A

GROUP: T12

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- 1.** Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- D**
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - (d.)** Crystals forming in the magma
- 2.** Which of the following would be considered a negative feedback to increasing global temperature?
- A**
- (a.)** Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ~~b.~~ Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ~~d.~~ An increase in desert formation resulting in more dusting blowing into the atmosphere
- 3.** Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- C**
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - (c.)** A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- 4.** Which of the following statements about the greenhouse effect on Earth is most accurate?
- A**
- (a.)** Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- 5.** Which of the following would cause the acidity of Earth's oceans to decrease?
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- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - (c.)** A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- 6.** Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- B**
- a. Reservoir A has a shorter residence time than Reservoir B.
  - (b.)** Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

1. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - ☒ d. The reservoir's residence time is 10 years.
2. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
3. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
4. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - ☒ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

A42204525

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

15

a. Ocean acidification occurs when more ions/particles are present in the water. When  $\text{CO}_2$  mixes with the water the  $\text{CO}_2$  particles break apart when dissolved in the water. This causes an increase in the oceans dissolved particles and saturates the water. When salt is added to the water the molecules also break apart and saturate the water. This makes the water more dense than before because it has an increased amount of dissolved ions. so an increase in atmospheric  $\text{CO}_2$  levels would also cause an increase in ocean acidification, thus  $\text{CO}_2$  levels in the ocean would also increase. As more water is added the levels become less saturated and particles are more spread out. When water is taken out more particles can't break their bonds which increases density and saturates the water.

Not clear

b. Negative feedbacks occur when more  $\text{CO}_2$  is released into the ocean such as increased water saturation, more alge cover, and deminished water quality. Positive feedbacks occur such as

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

5 a. The greenhouse effect increases when infrared light is trapped within the atmosphere. This happens when some of the sun's visible rays do not bounce back to space and are absorbed in the atmosphere. As the atmospheric temperature increases the continental crust increases in temperature causing the molten rock to heat up and become less dense. Magma begins to form at the divide. When eruption occurs ash clouds form and block some of the sun's rays. This blockage also traps rays in the atmosphere when they try to bounce back into space. Ultimately more rays will be trapped, increasing the greenhouse effect, and thus increasing the earth's atmospheric temperature.

b. When ash clouds cover the surface and block solar radiation the temperature decreases but the trapping of radiation will cause increased atmospheric temperatures to occur.

Extra credit (2 points).

✓ How are evaporation and degassing similar and/or different?

Evaporation is the process at which water turns into a gas. And degassing is releasing of gas to liquid similar concepts but turning to different forms.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

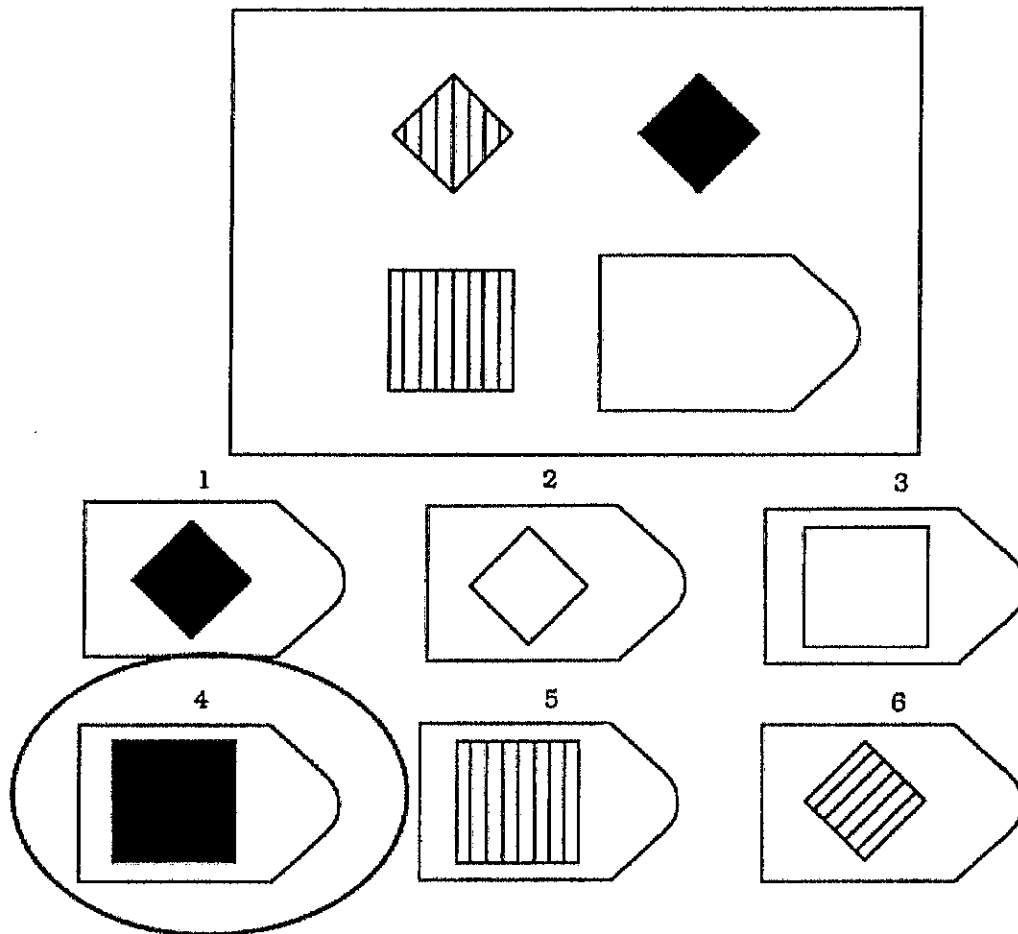




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*



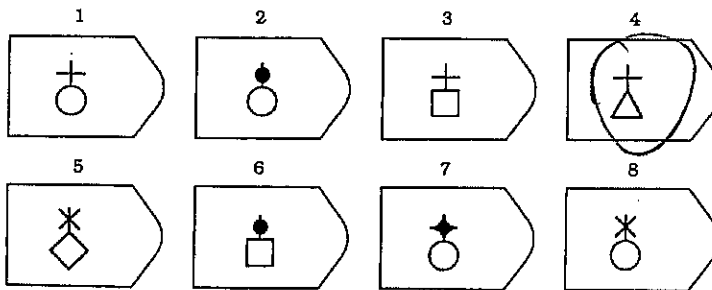
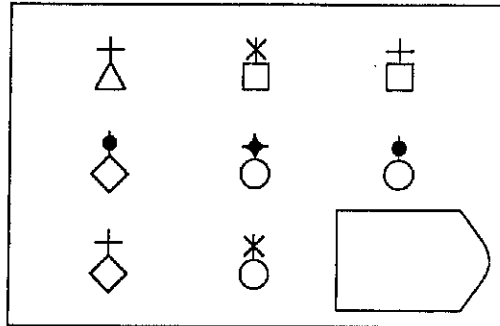
**Answer: 4**

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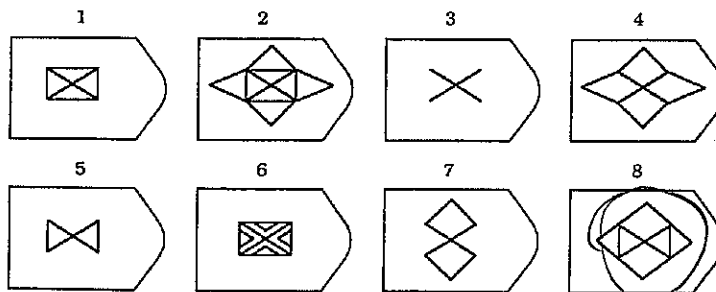
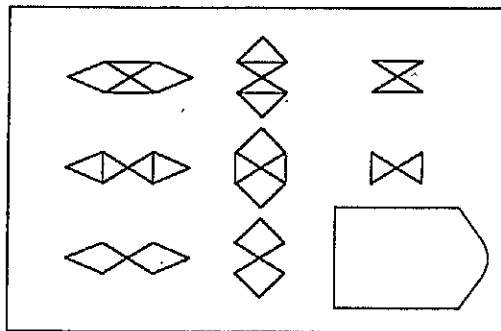
A12204525

Please choose the image that best completes each of the following patterns.

### PATTERN 1



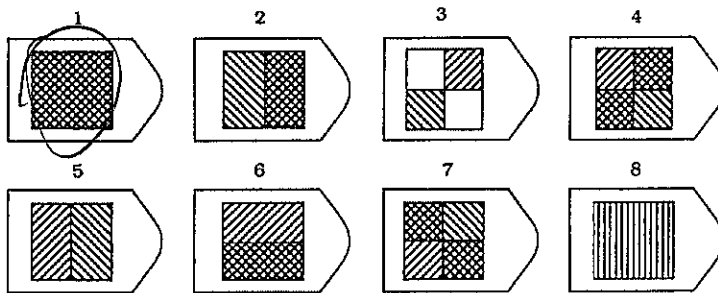
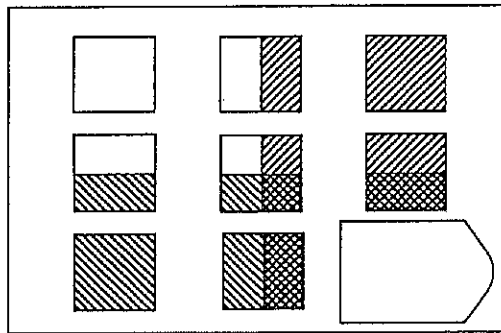
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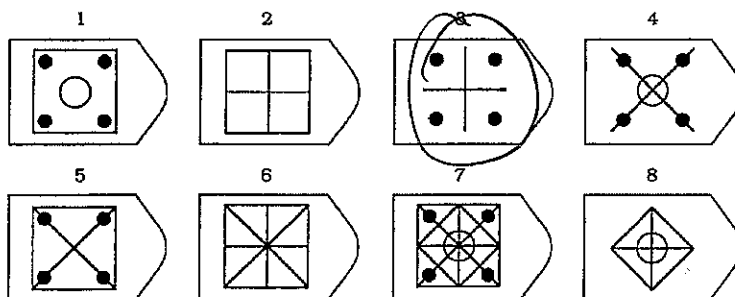
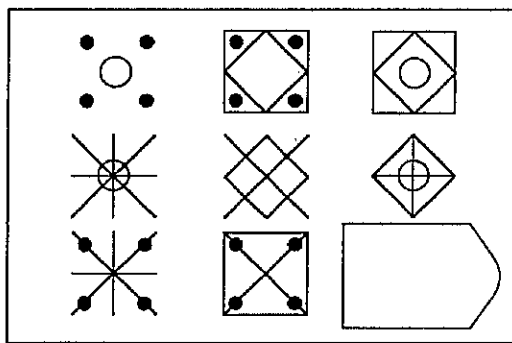
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## PATTERN 3



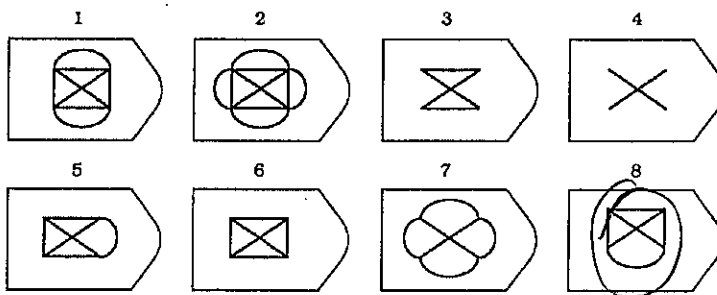
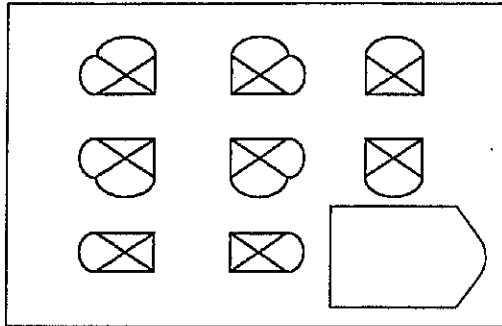
## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

A42204525

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- ☒ B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☒ (A) The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...
- ☒ (A) An ice cube in water. They are similar because they both are less dense than the surrounding material.
  - B. A leaf in the air. They are similar because they both move through the air carried by the wind.
  - C. Blowing bubbles. They are similar because they both float until they eventually pop.
  - D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- A. Getting the flu. They are similar because they are both caused by viruses.
  - B. Getting pink eye. They are similar because they are both contagious.
  - C. Getting the flu. They are similar because they are both caused by not washing your hands.
  - D. Forgetting to do your homework. They are similar because they are both preventable.
  - ☒ (E) Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48873

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

1

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

**STUDENT NAME:** A 43499348  
Version A

**GROUP:** T12 84

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder  
☒ b. Gas bubbles forming in the magma B  
c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
  
2. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. Melting of permafrost resulting in more methane escaping into the atmosphere  
☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat C  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
  
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition C  
☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. A = dissolution, B= deposition, C= uplift and deposition
  
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
☒ b. Natural processes are the primary cause of the greenhouse effect. B  
c. Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
  
5. Which of the following would cause the acidity of Earth's oceans to decrease?  
☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide. A  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
  
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. Reservoir A has a shorter residence time than Reservoir B.  
☒ b. Reservoir B has a shorter residence time than Reservoir A. B  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- B
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- A
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- B
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☒ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
- D

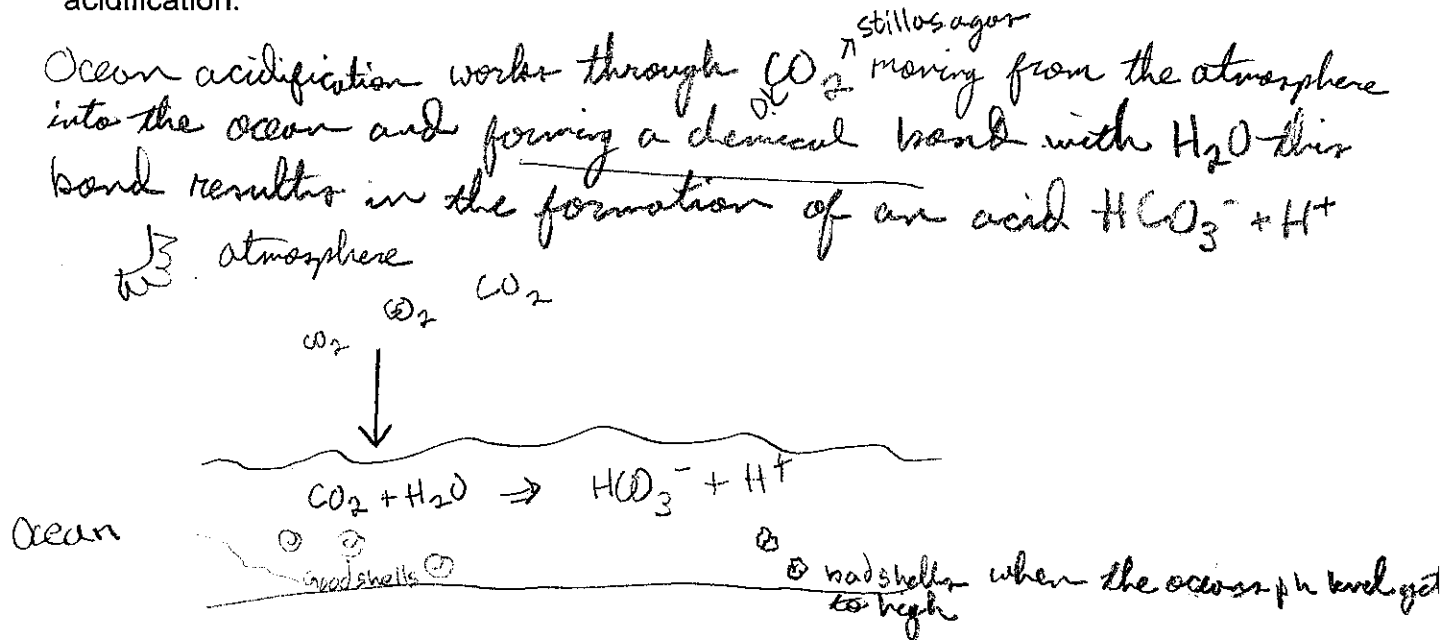


SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.



If the amount of  $\text{CO}_2$  in the atmosphere were to increase this would result in the warming of Earth's temperature which would also cause the ocean's temperature to rise which is an example of positive feedback however this rise in ocean temperature slows the process of ocean acidification because the molecules in the water are moving so fast that it's harder for the  $\text{CO}_2$  to enter the ocean. In the end though the increase of  $\text{CO}_2$  in the atmosphere will result in the increase of ocean acidification because an equilibrium will be tried to be reached between the amount of  $\text{CO}_2$  in the atmosphere and the ocean. This increase of  $\text{CO}_2$  in the ocean can lead to the killing of a vast majority of marine life if the pH level rises and throws off their natural balance.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

22

Concepts  
X if

a) Explanation of the greenhouse effect: The sun emits light waves in the form of visible, ~~ultra violet~~ and ~~infrared~~. These light waves pass through our earth's atmosphere and some of them are absorbed by our earth's surface. These are mainly the visible ~~ultra violet~~ waves. <sup>Some</sup> of the infrared waves however are reflected by earth's surface back into the earth's atmosphere. This is the part where the greenhouse gases come in. Greenhouse gases such as CO<sub>2</sub>, Methane & water vapor <sup>some of these</sup> absorb these infrared waves disallowing them from <sup>all</sup> just leaving earth's atmosphere into outer space. The trapping of these infrared waves by these greenhouse gas molecules causes the molecules to become very energized and ~~reflect~~ the infrared light waves back towards earth's surface. This process is called the greenhouse effect. The greenhouse effect allows for earth's climate to be the way it is because if we didn't have these greenhouse gases trapping some light waves the earth would have the climate of a desert everywhere. It would be hot during the day and become really cold at night because no heat from the sun would be trapped by earth instead it would all just drift back out to space.

b) If volcanism on earth suddenly increased dramatically causing large ash clouds to form all over earth then this would cause the atmospheric temperature to decrease. This would occur because the sun's light waves would not be able to pass through the large ash clouds caused by the volcanoes. Because of this earth's surface would not be able to absorb the usual amount of light waves from the sun and as a result the infrared waves to warm out the greenhouse effect in earth's atmosphere.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

7 Degassing is the movement of gas from one location to another like CO<sub>2</sub> moving from the atmosphere to the ocean. It does not change states & stays a gas. Evaporation changes states from a liquid to a gas.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

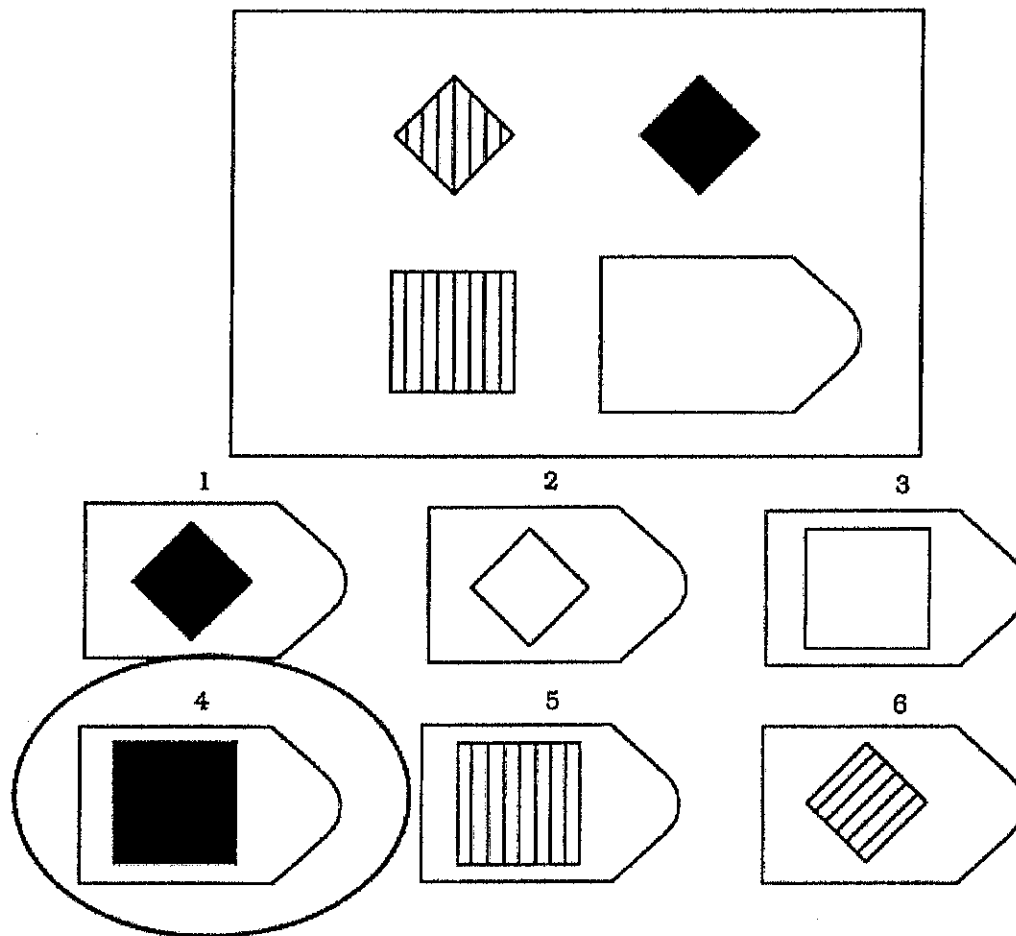
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

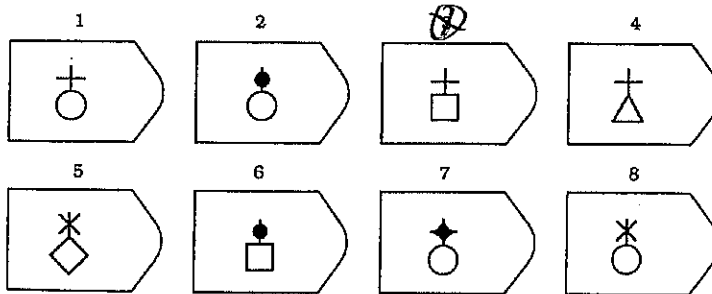
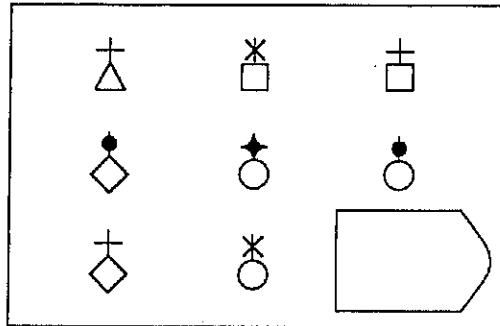


**Answer: 4**

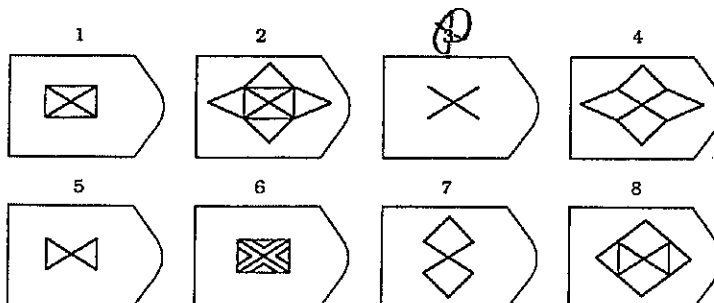
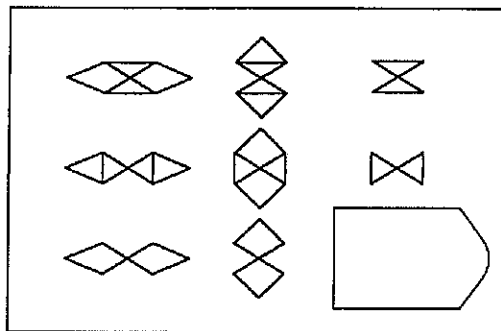
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

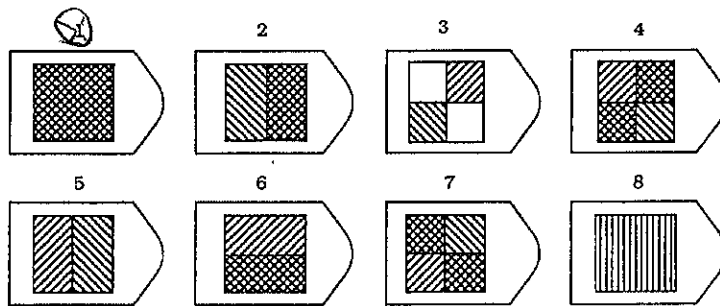
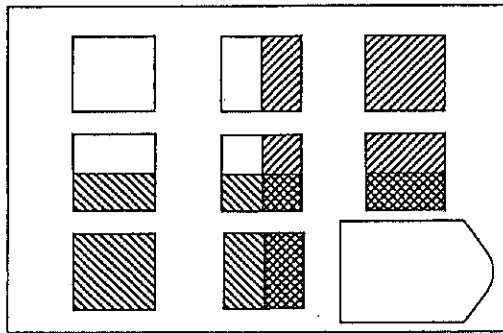
### PATTERN 1



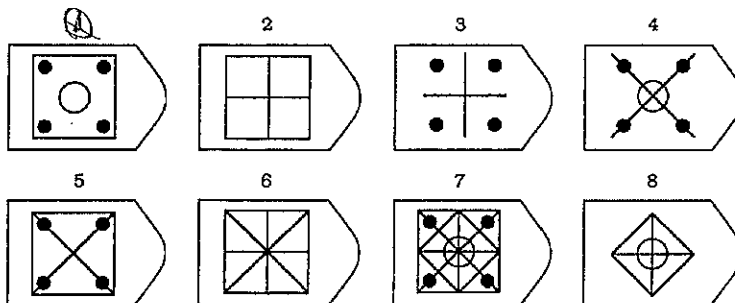
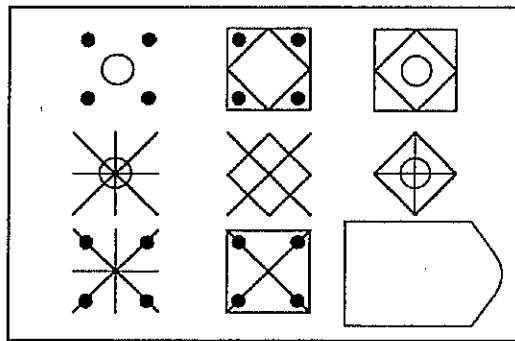
### PATTERN 2



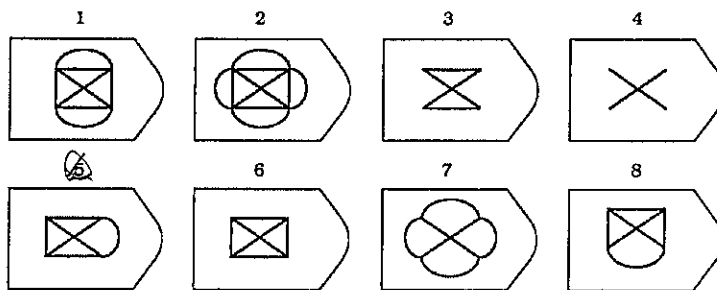
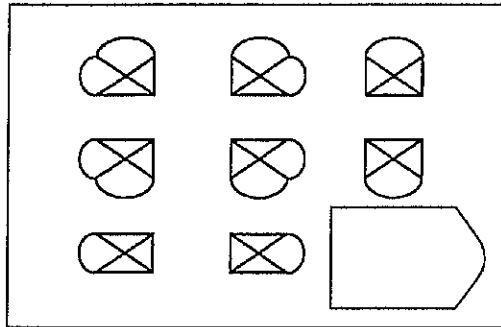
## PATTERN 3



## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

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B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

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D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

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4. The rival gangs used graffiti to define their territorial boundaries.

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B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

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D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
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2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- ☒ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 49006

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A 41439593  
Version A

GROUP: T12

87

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

✓

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

a. An increase of atmospheric carbon would lead to an increased rate of ocean acidification. Because there is more  $\text{CO}_2$  in the air, more  $\text{CO}_2$  would settle <sup>OK</sup> into the ocean. When  $\text{CO}_2$  settles in the ocean and dissolves <sup>OK</sup> with  $\text{H}_2\text{O}$ , it becomes acidic. This increase in ocean acidification could have dramatic repercussions, such as a decline in coral reef expansion as well as fluctuations in fish populations for specific regions. 25

b. However, as the  $\text{CO}_2$  in the atmosphere warms the air, the oceans would warm as well. As oceans warm, they would become less able to retain gases, such as  $\text{CO}_2$ . Therefore, the oceans would not ~~acidify~~ acidify

as quickly as if they retained a cool temperature. This is considered a positive feedback loop because more  $\text{CO}_2$  in the air leads to warmer oceans which, in turn, leads to more  $\text{CO}_2$  in the air. If oceans absorbed more  $\text{CO}_2$  as they warmed, it would be a negative feedback loop because more atmospheric  $\text{CO}_2$  in the air would lead to more heat in the ocean which would absorb more  $\text{CO}_2$  and leave less in the air.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

20

If volcanism were to suddenly increase dramatically, ash clouds would erupt into the sky. The increase in ash in the atmosphere would likely block out large amounts of solar radiation. Because less solar radiation would be able to penetrate the atmosphere, less solar radiation would be able to reach earth <sup>missing step</sup> (and less infrared radiation would be absorbed by atmospheric gases.) Because solar radiation is what warms the earth, the ash clouds would cause the earth's temperature to decline. As earth's temperature declines, more ice would form, reflecting even more solar radiation and causing an even greater decrease in temperature. This is known as a positive feedback loop.

Although the volcanoes would release methane and CO<sub>2</sub> to absorb more infrared radiation, the ash clouds would counteract this by deflecting radiation. As a result, the earth would continue to cool.

**Extra credit (2 points).**

2 How are evaporation and degassing similar and/or different? evaporation and degassing both release gases into the atmosphere. evaporation releases gases from water. Degassing ~~does~~ does as well, but can also occur in rocks or other material. ~~However~~ However, ~~evaporation~~ evaporation converts a liquid to a gas, whereas degassing transports gases elsewhere.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

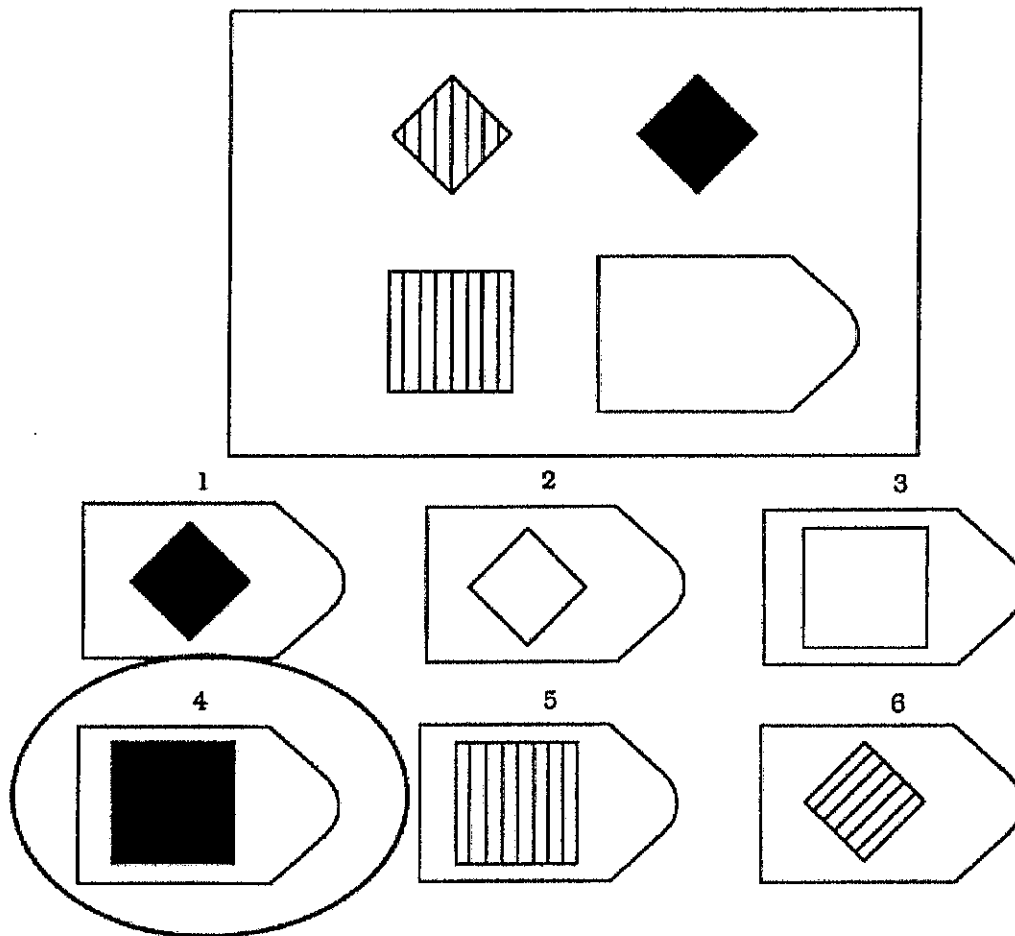




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

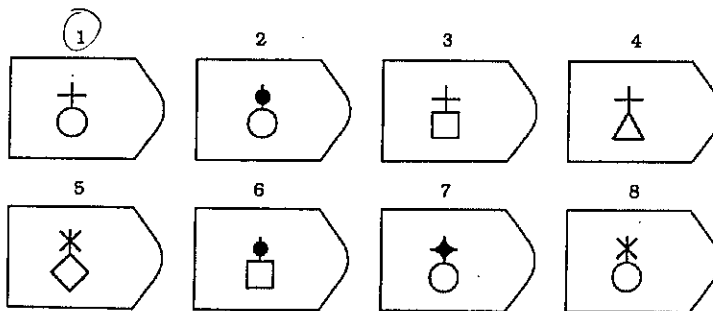
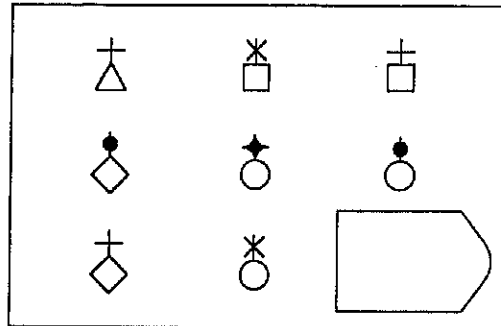


Answer: 4

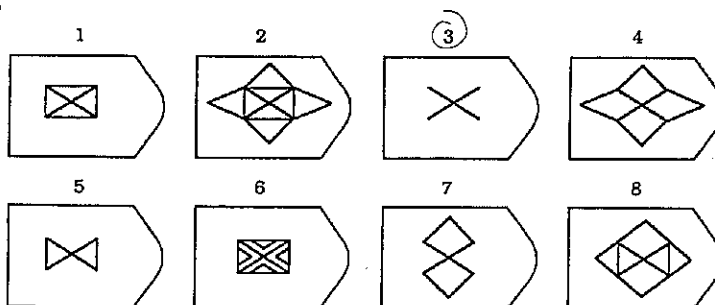
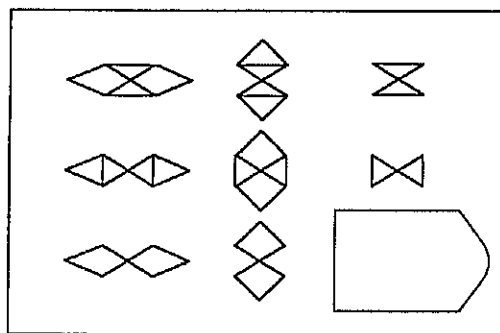
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

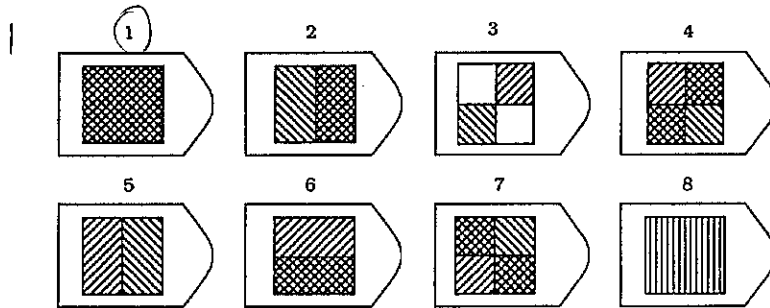
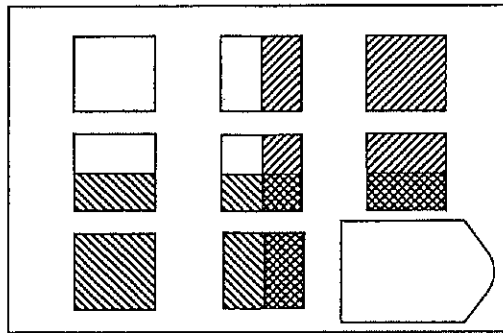


### PATTERN 2

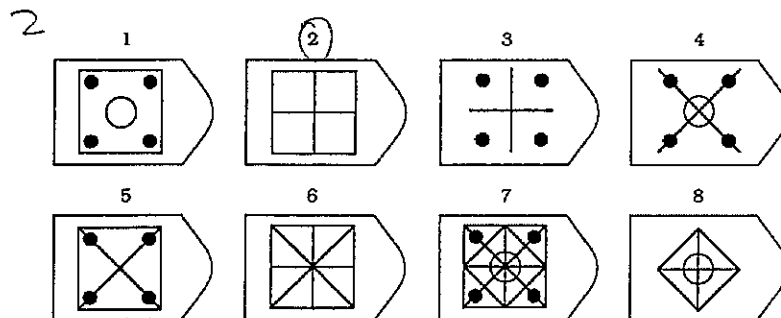
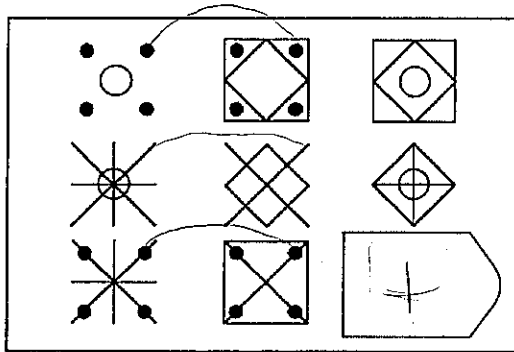


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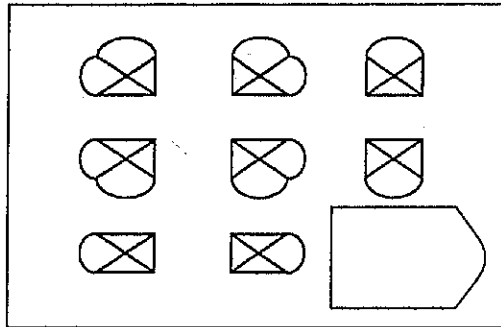
## PATTERN 3



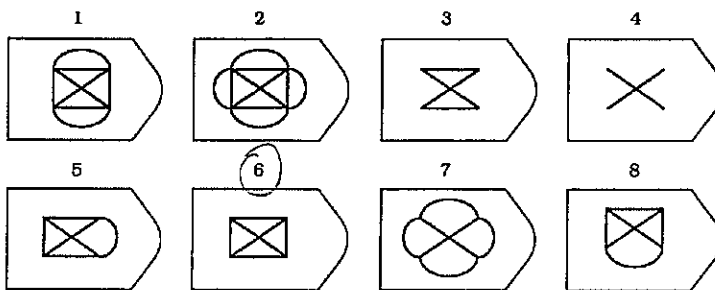
## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

6



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.

B. ☒ Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.

C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.

D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

A. Before the annual parade, the city council decided to renovate one of the buildings downtown.

B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.

C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.

D. ☒ Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

A. ☒ The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.

B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.

C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.

D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

C. ☒ The toddler wrote on the walls with pens when the babysitter wasn't looking.

B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.

C. ☒ The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.

D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- ☒ A. The plumber fixed the pump that had burst and flooded the basement.
- B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
- C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
- ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

**Please choose the response that is closest to an analogy that you might make.**

1. A balloon floating is like...
- A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- ☒ C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.
2. Catching a cold is like...
- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- ☒ C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 49201

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

80 1

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A43915317  
Version B

GROUP: T13

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?

- A
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere *positive*
  - ☐ c. An increase in evaporation and cloud formation resulting in the release of latent heat *+*
  - ☐ d. An increase in desert formation resulting in more dusting blowing into the atmosphere *decreased temp.*

2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- ☐ a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - ☐ c. The surrounding crust becoming hotter
  - ☐ d. Crystals forming in the magma

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- D
- ☐ a. A= erosion, B= deposition, C= uplift and erosion
  - ☐ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☐ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ☒ d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- C
- ☐ a. Human activities are the primary cause of the greenhouse effect.
  - ☐ b. Natural processes are the primary cause of the greenhouse effect.
  - ☒ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ☐ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☐ e. The human and natural causes of the greenhouse effect are not understood.

5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- B
- ☐ a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - ☐ c. Reservoir A and Reservoir B have equal residence times.
  - ☐ d. More information about Reservoir A and Reservoir B is needed.

6. Which of the following would cause the acidity of Earth's oceans to decrease?

- A
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - ☐ b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☐ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

*Any decrease in ocean temp. allows for more CO<sub>2</sub> to diffuse into ocean waters.*

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- ☒ b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- ☒ b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

*Emission rates were slightly higher in 1990 so this could also be C and remain about the same*

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

25

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

1A Ocean Acidification is determined primarily by the amount of  $\text{CO}_2$  that diffuses into the ocean. When the  $\text{CO}_2$  in the ocean reacts with  $\text{H}_2\text{O}$  it forms both carbonic acid and hydrogen ions are formed. The formation of carbonic acid in the hydrosphere is directly correlated to the acidity of oceans. The more carbonic acid that is present in ocean water, the more acidic the ocean is.

1B A negative feedback loop that is related to ocean acidification can be explained for example if a large number of trees are recently cut down and as a result, there is more  $\text{CO}_2$  in the atmosphere. A large amount of  $\text{CO}_2$  in the atmosphere then diffuses into the oceans. Some  $\text{CO}_2$  then reacts with  $\text{H}_2\text{O}$  to form Carbonic Acid and  $\text{H}^+$ . This increases the acidity of the oceans and can potentially destroy coral reefs that are made out of limestone. The destruction of limestone and increased acidity in the ocean can then lead to the depletion of oceanic organisms.

A positive feedback that is related to ocean acidification is that when more  $\text{CO}_2$  is prevalent in the atmosphere, the atmospheric temperature tends to increase due to the increased level of this greenhouse gas ( $\text{CO}_2$ ). The increase in atmospheric temperature then in turn increases the temperature of the oceans. The higher the ocean temp. is, the less amount of  $\text{CO}_2$  can be diffused into the oceans. As a result, more  $\text{CO}_2$  remains in the atmosphere which increases the amount of Greenhouse gas in the atmosphere. This means more infrared radiation is trapped in the atmosphere and the global temp will continue to get warmer and warmer.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- b. Clear connections between events and changes in atmospheric temperature.

23

A. If there was an increase in volcanism, there would also be a large amount of volcanic ash clouds that would form in the upper atmosphere. This volcanic ash would block much of the visible sun rays from penetrating the atmosphere and becoming infrared radiation. This alone would cause a decrease in atmospheric temp. The greenhouse effect is also still prevalent in the atmosphere as well. Greenhouse gases such as CO<sub>2</sub> and methane act as an atmospheric blanket. Visible light rays from the sun penetrate the atmosphere and find its way to Earth where much of the visible light is refracted and changes wavelength becoming infrared radiation. The <sup>visible converts to</sup> infrared radiation is absorbed by Earth but is then re-emitted into the atmosphere. When the infrared radiation finds its way to the greenhouse gas and when the infrared comes in contact with the greenhouse gases, the greenhouse gases become excited and much of the infrared radiation is re-emitted back to Earth while some escapes the atmosphere into space. This process continues to occur and is referred to as the greenhouse effect.

B. Some events that have had a connection to changes in atmospheric temp. is the massive volcanic eruptions that occurred in the past that resulted in a large amount of ash to accumulate in the atmosphere and blocking a majority of sunlight from reaching Earth which meant a decrease in infrared radiation on Earth.

Another event that has clear connections to changes in atmospheric temperature but not so much to volcanism is the Black Plague. Next  
Page

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are different because evaporation is the changing of water from liquid to gas while in degassing CO<sub>2</sub> remains a gas the entire time although it moves from hydrosphere to the atmosphere.

Continued

During the Black Plague, a majority of the population died and this resulted in a decrease in the need to produce as many crops. As a result many fields began to go through reforestation. The drastic increase in plants in turn drastically reduced the amount of atmospheric  $\text{CO}_2$ . This decreased the overall Temp. of Earth and is referred to as "The Little Ice Age."

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

E.C. Continued

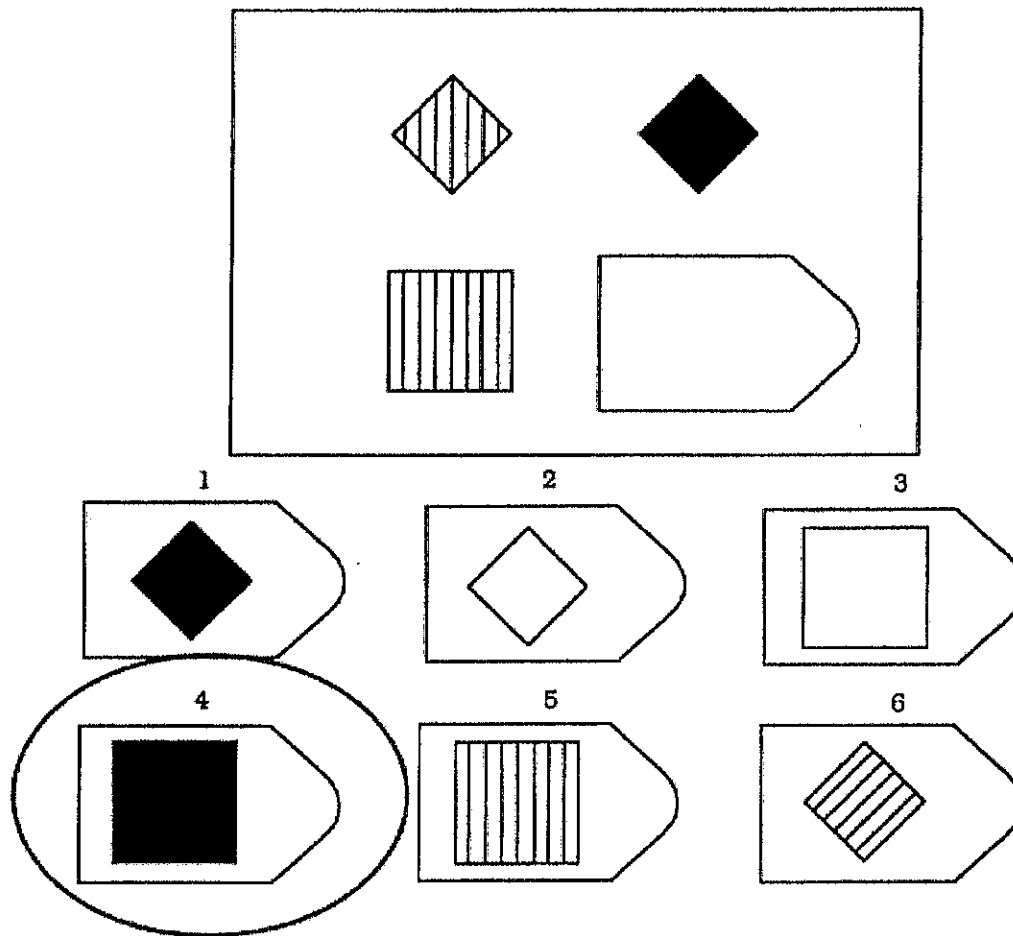
They are similar both evaporation and degassing are processes where compounds are moving from hydrosphere to atmosphere.



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

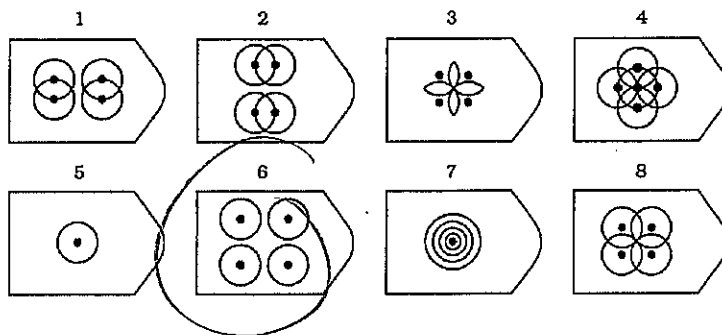
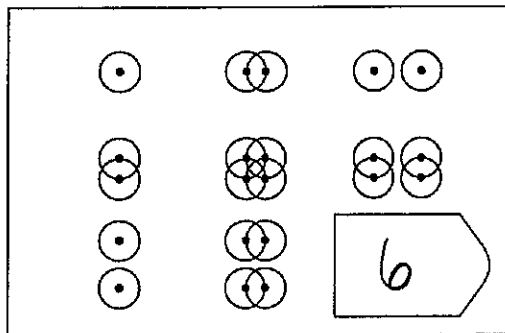


**Answer: 4**

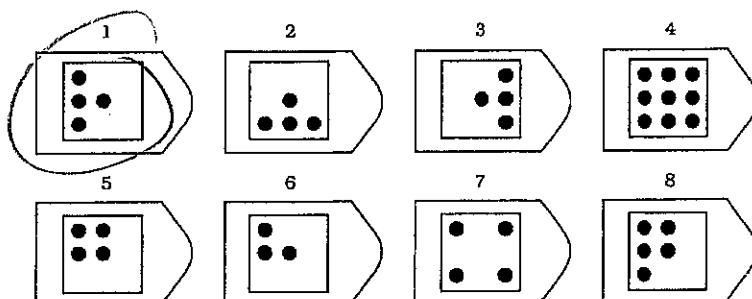
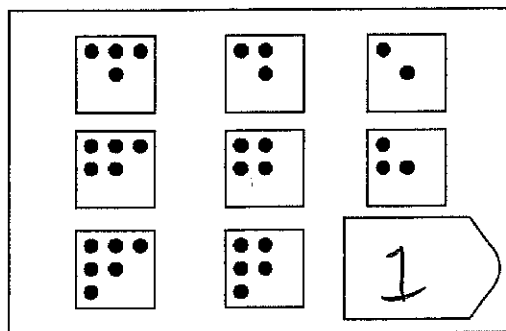
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Please choose the image that best completes each of the following patterns.

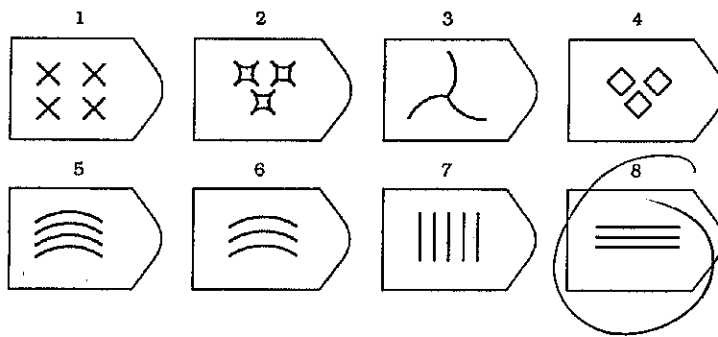
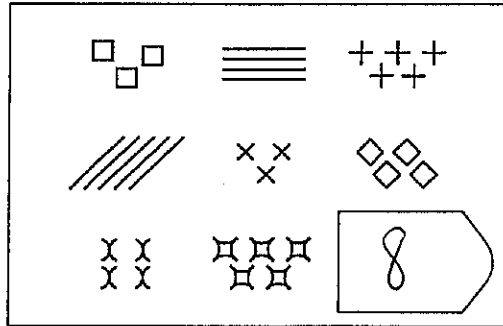
### PATTERN 1



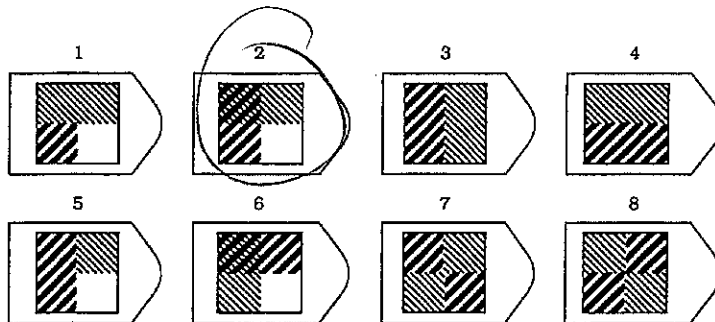
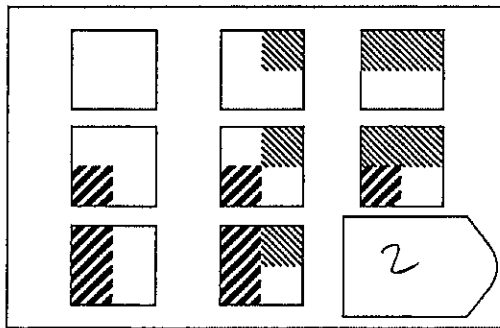
### PATTERN 2

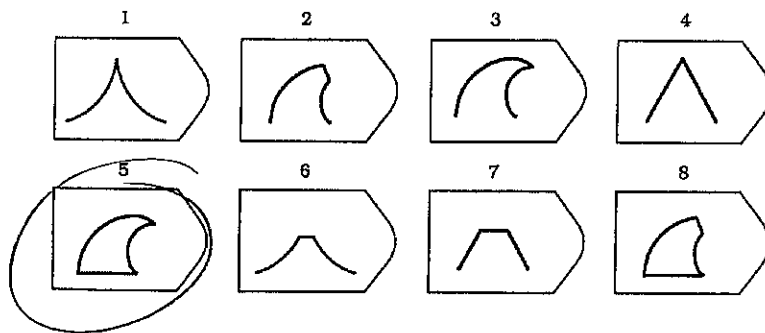
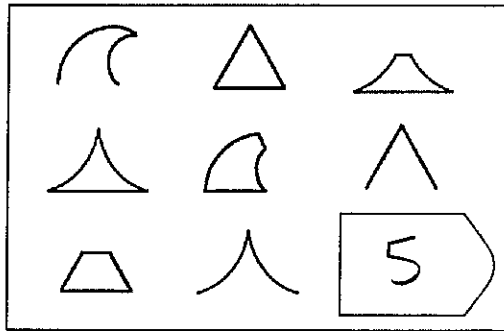


## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
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- ☒ A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
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- D. Eating too much candy. They both involve lack of self-control.
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- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48894

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: 442383975  
Version B

GROUP: T13

65

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere
  
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
  
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - ☒ b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
  
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
  
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
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  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
  
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

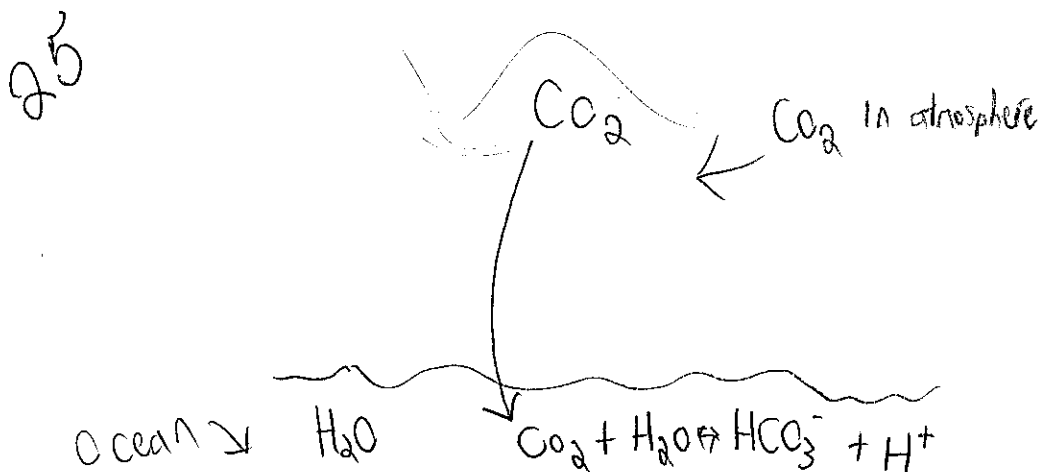
**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the dissolving of  $\text{CO}_2$  into the ocean to form  $\text{HCO}_3^-$  (Carbonic acid) <sup>(reaction helped by solar radiation)</sup> which makes the water acidic. If there is more carbon dioxide in the atmosphere then more carbon dioxide can be dissolved into the ocean but you must realize that more  $\text{CO}_2$  means a warmer atmosphere and a warmer ocean which does not absorb as well as a cold ocean which helps limit the  $\text{CO}_2$  intake (Negative feedback). A positive feedback could be the example of marine organisms that take  $\text{CaCO}_3$  out of the ocean to be used as shells. Due to ocean acidification these animals are having trouble forming their shells and are in danger of dying out which would be a compound effect (positive feedback) because ocean acidification would be creating more ocean acidification with the removal of these animals.



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

10

When volcanoes erupt they release large amounts of  $\text{CO}_2$  into the atmosphere which is a greenhouse gas, with that said the huge ash clouds caused from the volcano would block off light the Earth obtains from the sun, which would cause a global winter for however many years until the ash settles. At this point <sup>(after the ash settles)</sup> all the greenhouse gases that were spewed from the volcano would begin trapping heat received from the sun again and cause a dramatic increase in temperature. In conclusion, regardless of the greenhouse gases the giant ash clouds would prevent/block energy from reaching the Earth in the first place causing global winter & once that ash settles and large amounts of energy begin hitting the Earth again all the greenhouse gases would begin trapping heat again causing temperatures to rise.

side note - If large amounts of vegetation was killed off in the global winter then  $\text{CO}_2$  levels would stay at a high rate for a longer period of time because none is converted to biomass from trees.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

X Evaporation is the gas obtained from heated liquids while degassing is the gas obtained from heated solids with pressure on them

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

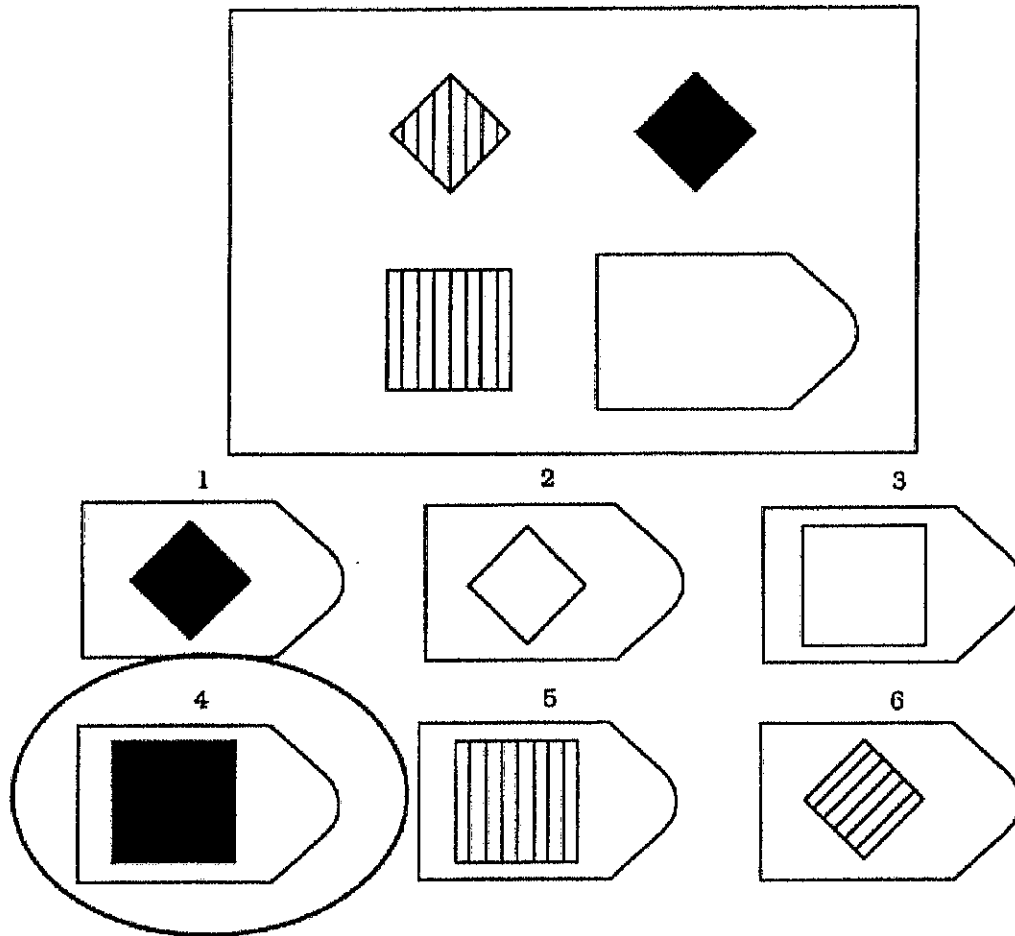




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

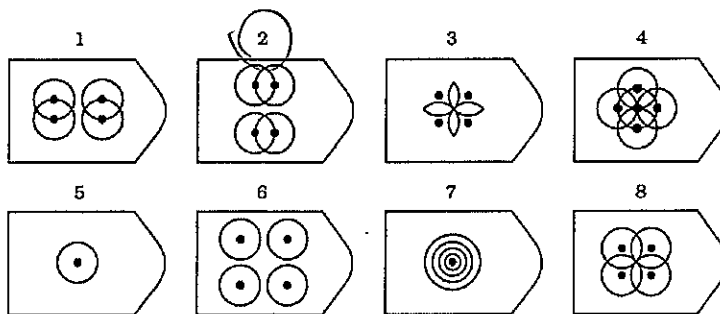
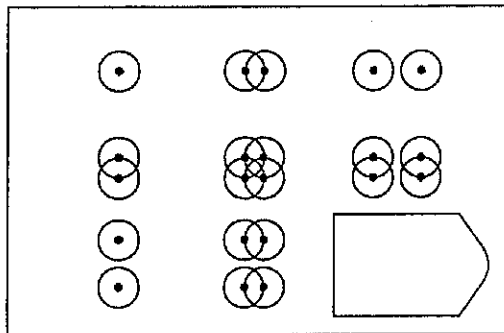


**Answer: 4**

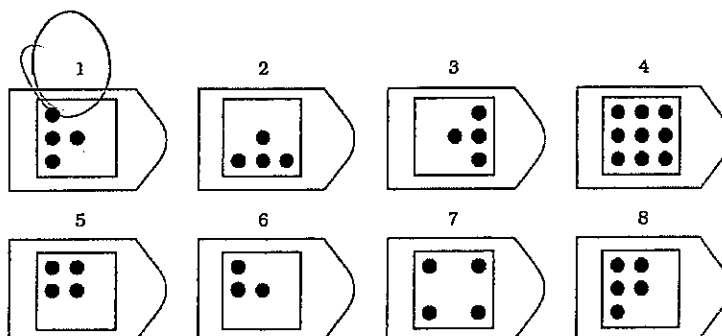
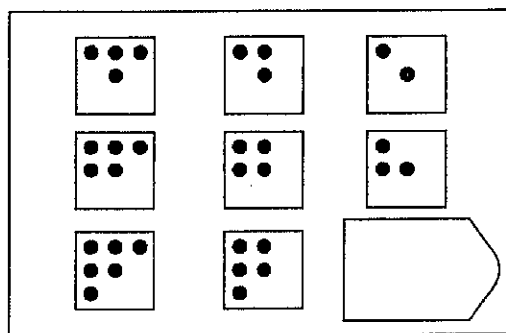
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

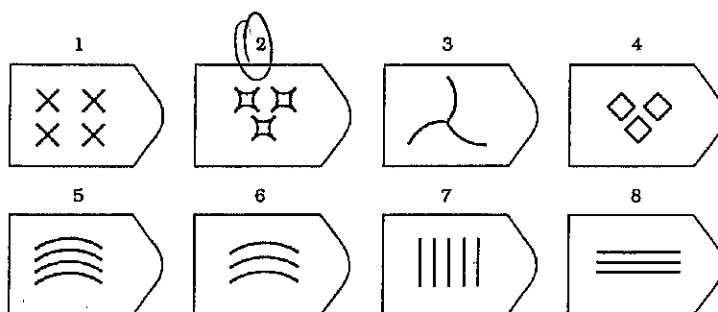
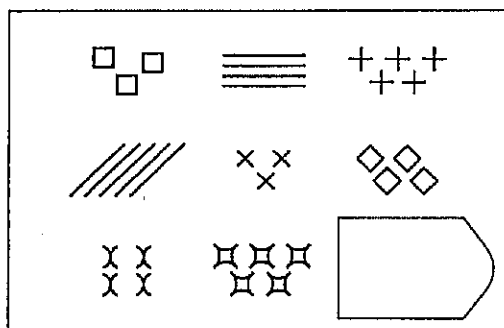
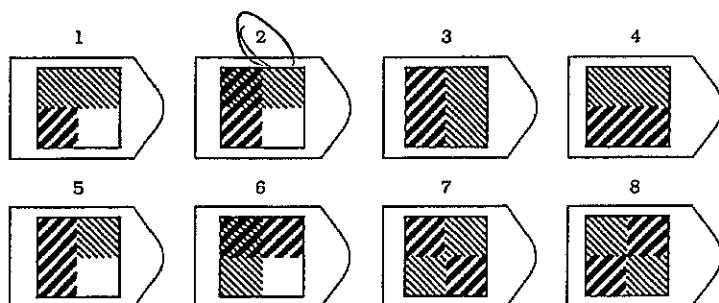
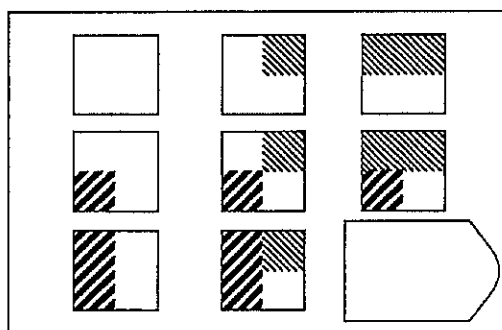
### PATTERN 1

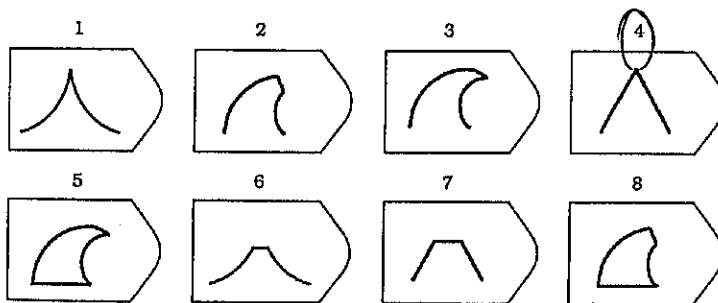
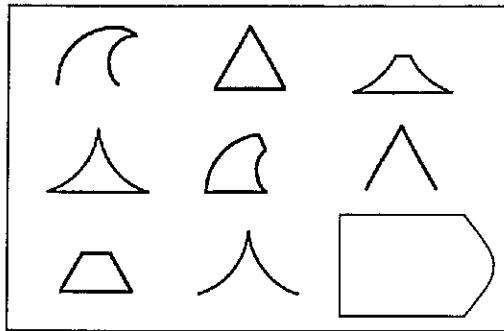


### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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PLEASE CONTINUE ON NEXT PAGE

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- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
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## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 44221

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

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- ☐ African American/Black
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- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

STUDENT NAME: A 34305310  
Version B

GROUP: T13

80

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
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  - ☒ d. A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
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**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
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8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
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A34305310

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the process by which  $\text{CO}_2^{(\text{gas})}$  enters the ocean, reacts with the  $\text{H}_2\text{O}$  to form  $\text{HCO}_3^-$  and  $\text{H}^+$  ions.

The more  $\text{H}^+$  ions there are, the more acidic the ocean water becomes. Therefore, if more  $\text{CO}_2$  is present in the atmosphere there will be more  $\text{CO}_2$  available to enter the oceans, which will cause more  $\text{H}^+$  ions to be present, making the oceans more acidic.

Positive feedback: if more  $\text{CO}_2$  was present in the atmosphere, this would increase the acidity of the oceans as there would be more  $\text{CO}_2$  available to be "taken in" by the oceans, which would produce more  $\text{H}^+$  ions. If there was more  $\text{CO}_2$  in the oceans, there would be more available to degas out into the atmosphere, increasing the concentration of  $\text{CO}_2$  in the atmosphere, which allows more  $\text{CO}_2$  to be taken up by the oceans later...

Negative feedback: if more  $\text{CO}_2$  was present in the atmosphere, this would increase earth's temperature (as  $\text{CO}_2$  is a greenhouse gas) and increase the acidity of the oceans (more  $\text{CO}_2$  into oceans, more  $\text{H}^+$  ions formed). If the earth's temperature increased, the ocean temperature would increase, which would decrease the amount of  $\text{CO}_2$  the ocean could "hold", which would decrease the  $\text{CO}_2$  concentration in the ocean and thus decrease acidity. 25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

When volcanism occurs,  $\text{CO}_2$  is released into the atmosphere. Solar radiation from the sun strikes the earth's surface, as mostly visible light, and is either absorbed, reflected back into space, or <sup>emitted</sup> reflected back within the atmosphere as infrared radiation.  $\text{CO}_2$ , a greenhouse gas, traps this reflected infrared light and re-reflects it back within the earth's atmosphere and to the earth's surface. In this way, this  $\text{CO}_2$  gas "traps" solar radiation within the earth's atmosphere. When a volcano erupts, it releases an excess of  $\text{CO}_2$  into the atmosphere, which causes more reflected solar radiation to be absorbed and re-reflected back, which causes an increase in earth's temperature. As the concentration of  $\text{CO}_2$  is increased, the temperature is increased via the process explained above.

23

dc ASH?

2

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the change from a liquid to a gas. Degassing is the "movement" of a gas in solution to a gas in the atmosphere.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

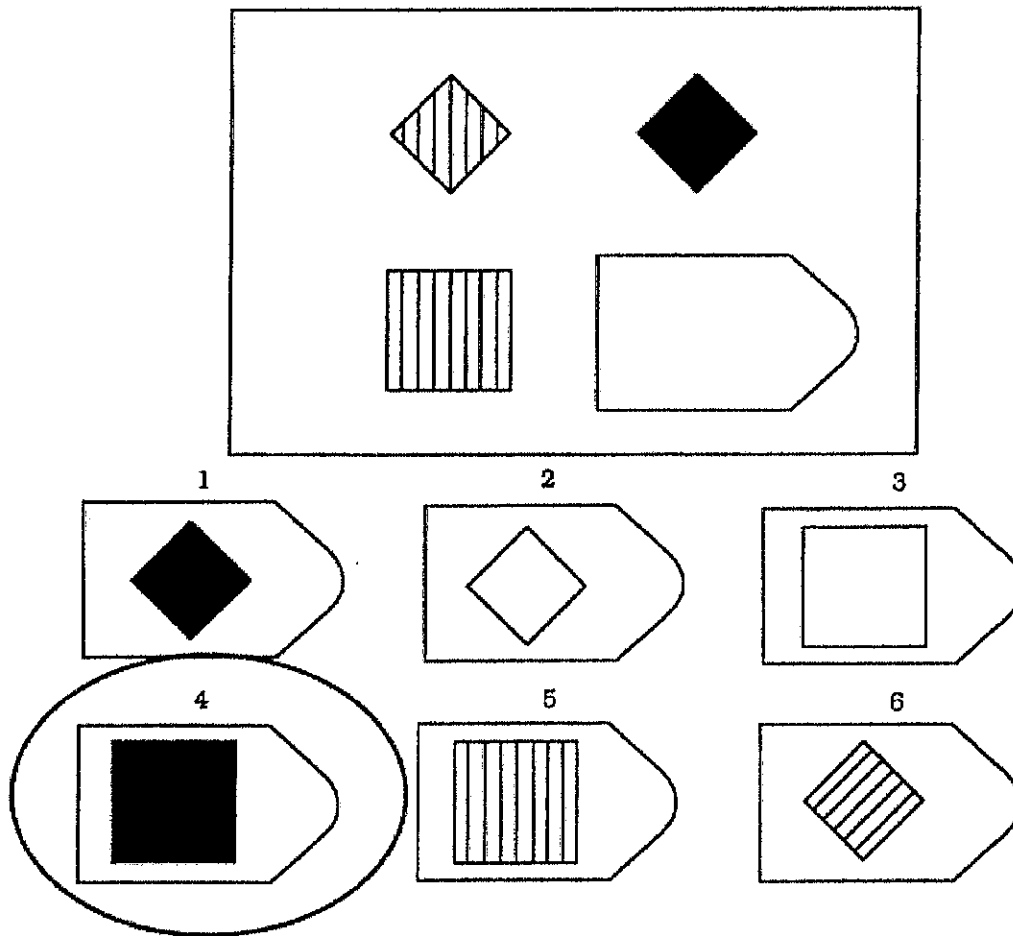
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

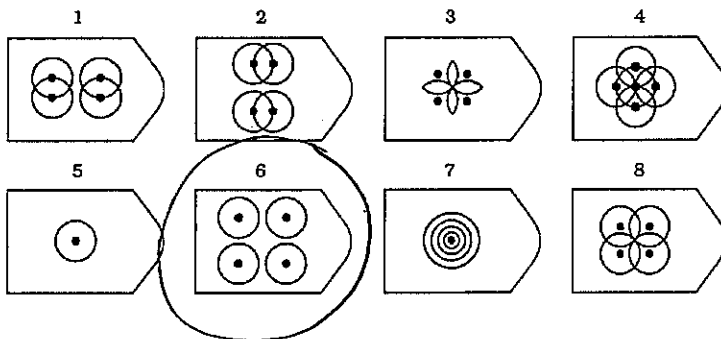
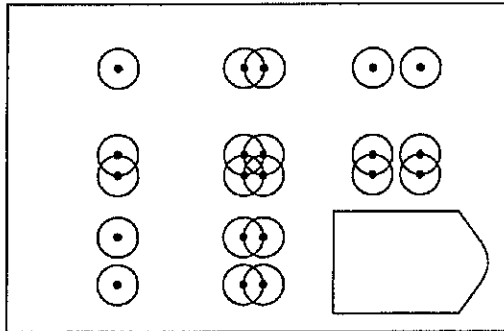


**Answer: 4**

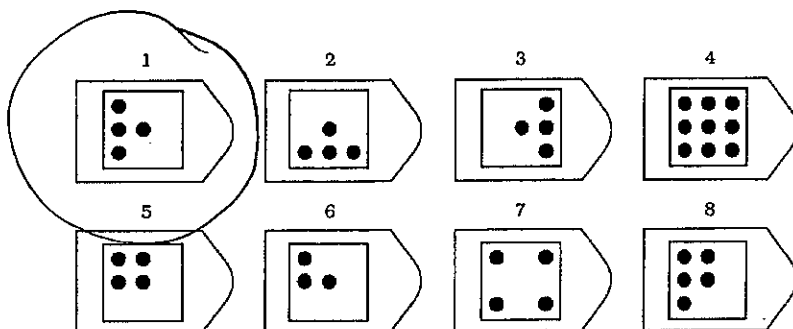
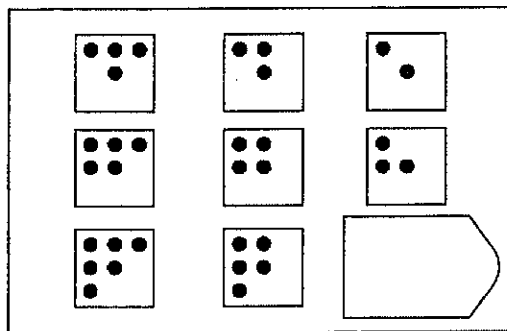
PLEASE CONTINUE ON NEXT PAGE

Please choose the image that best completes each of the following patterns.

### PATTERN 1

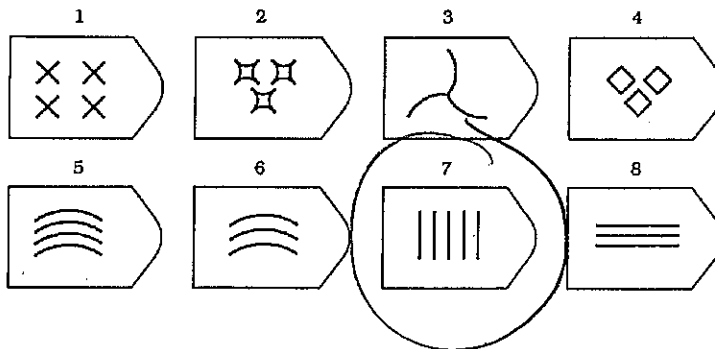
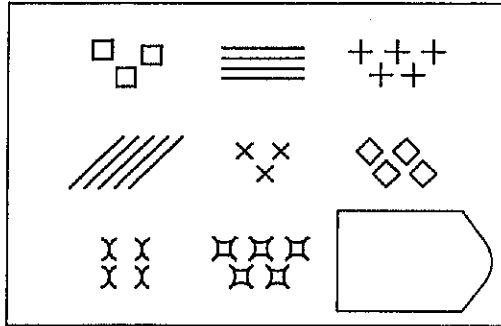


### PATTERN 2

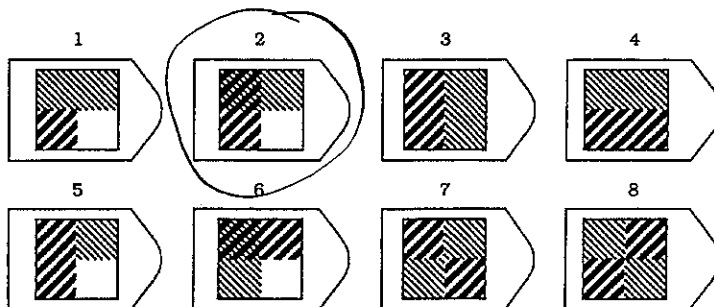
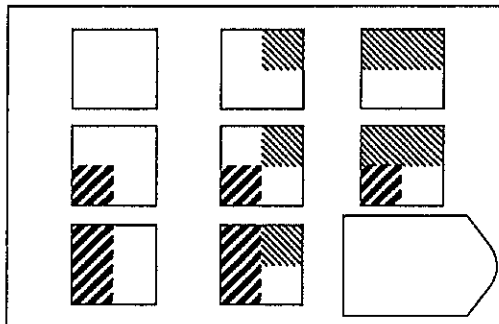


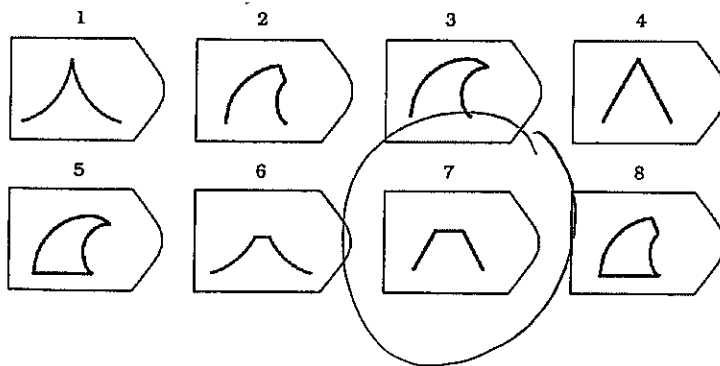
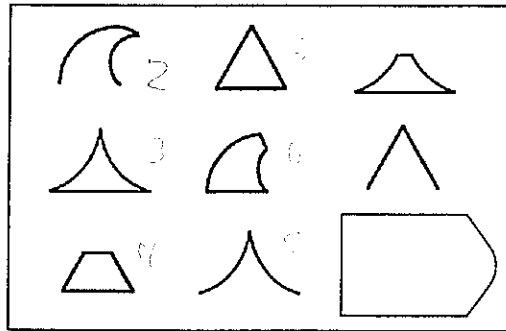
A34305310

## PATTERN 3



## PATTERN 4



**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
  - C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
  - D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- ☒ C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 24 years

What is your home zip code? 48843

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

1

65

STUDENT NAME: A42773599  
Version B

GROUP: T13

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ☒ d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?
  - ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

Warmer water  
is moving  
faster and  
won't let CO<sub>2</sub> in

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- The reservoir will eventually disappear.
  - ☒ The reservoir is not in equilibrium.
  - The reservoir is growing smaller.
  - The reservoir's residence time is 10 years.

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

We polluted less  
so less pollution/greenhouse  
gas  
less greenhouse  
effects

- ☒ The Earth's atmosphere would become colder than it is today.
- The Earth's atmosphere would become warmer than it is today.
- The Earth's atmosphere would remain about the same temperature as it is today.
- The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ Reflection of more solar radiation, causing atmospheric temperature to decrease
- Reflection of more solar radiation, causing atmospheric temperature to increase
- Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- ☒ More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

Doesn't  $\text{H}_2\text{O}$  in atmosphere ~~be~~ help the greenhouse effect? So increasing clouds would help the greenhouse effect and make it warmer and warmer and warmer, just like positive feedback

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the process where  $\text{CO}_2$  in the atmosphere enters/dissolves in the Ocean and with the combination of  $\text{H}_2\text{O}$  becomes  $\text{HCO}_3^- + \text{H}^+$  which we all know is acidic. There are some factors that affect the rate and processes of this reaction. First it is good to know that it is easier to dissolve  $\text{CO}_2$  in cold water than in warm water. This is due to the fact that ~~the~~  $\text{H}_2\text{O}$  molecules in warm water have more energy than molecules in cold water, which means warm water molecules are moving faster so it is harder for  $\text{CO}_2$  to dissolve ~~into~~  $\text{CO}_2$  molecules. Next I think it is important to understand the concept of equilibrium. I assume most know about equilibrium and that it is a state of "equality" ~~or~~ or balance. Changes in  $\text{CO}_2$  concentration in the atmosphere are reflected in  $\text{CO}_2$  in the ocean, if there is a greater concentration of  $\text{CO}_2$  in the atmosphere than the ocean,  $\text{CO}_2$  will move from high to low (atmosphere to ocean) to try to maintain equilibrium.

- Increase in  $\text{CO}_2$  in atmosphere means increase of  $\text{CO}_2$  in water due to  $\text{CO}_2$  in atmosphere going ~~to~~ in the water to maintain equilibrium. This is positive feedback.

25

- Increase  $\text{CO}_2$  in atmosphere leads to increase in temperature which makes it harder to get  $\text{CO}_2$  in the Ocean.  
— negative feedback

Increase in  $\text{CO}_2$  <sup>atmosphere</sup> means increase in temperature, and greater evaporation, therefore there is less water, so less  $\text{CO}_2$  can be dissolved in it.  
— negative feedback

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

10

The Greenhouse is the process where radiation from the sun that reaches the earth and while some radiation is absorbed on earth, (a large amount is reflected back to the atmosphere where it would normally escape) but due to certain gases known as greenhouse gases ( $\text{CH}_4$ ,  $\text{H}_2\text{O}$ ,  $\text{CO}_2$ ), portions of this radiation is reflected back to earth. When a volcano erupts it would have many effects, some sudden, and some gradual. If large amounts of ash were being released in the atmosphere by many volcanoes, the first thing one would notice would be the decrease in light energy from the sun reaching the earth. It would be dark, but it would also make more shade/insulation from the sun, which would cool down earth (kinda like clouds). However, it is more likely be an increase in global temperature due to greenhouse gases that are emitted into the atmosphere by volcanoes. An increase of these gases would serve to reflect even more escaping radiation (heat) back to earth. This would be a more gradual change than the more quickly noticeable increase in darkness, and would eventually overpower the cooling process brought on by ash clouds, and eventually the atmosphere temp would increase, greater temps mean more evaporation and cloud formation, and since clouds and water vapor help the greenhouse effect, raising temps. If the temperature was really really warm, the oceans would actually start evaporating/losing more water than it gained. This would mean a smaller reservoir for  $\text{CO}_2$  since a decrease in amount of water present would mean a decrease in amount of  $\text{CO}_2$  that can be dissolved. So eventually less  $\text{CO}_2$  would be able to reside in the oceans, so more would stay in the atmosphere and it would get warmer. Still → cont.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

evaporation is a change to gaseous state due to heat.  
degassing is a change to gas via chemical reaction

I was studying for calc/chem all day yesterday and forgot to do the HW but I did it early today, it would really help.

Also, The HW due over Spring Break, I did it, but the next day also, you had said you would maybe grade it if we emailed you explaining it. My friend Jordan Dennis said you gave him credit, but I didn't receive any.

I mailed you

Thank You very much for teaching. It was interesting and slightly relaxing compared to some stressful classes I have, I enjoyed it.

Thank You Jonathan Bonar  
Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

Essay Z cont.

Because ice melts when it gets warmer, the glaciers could melt, this would take a long time perhaps but if a large majority of the ice melted then the oceans would not have significant differences in the temperature. Ocean currents would have very little if any at all because if all the  $H_2O$  is the same, then there is no need to reach equilibrium so there would be no movement (or very little) of water. The same thing could also happen to the "wind" cycle. Air currents would stop having major roles due to a decrease in the differences of air temps.

Eventually there would be too much ash/greenhouse gases/clouds/vapor in the atmosphere, and the clouds and ash would block out the sun, causing darkness and scorching temperatures, this would kill most vegetation that helps reduce  $CO_2$  which would mean it gets **EVEN WARMER**

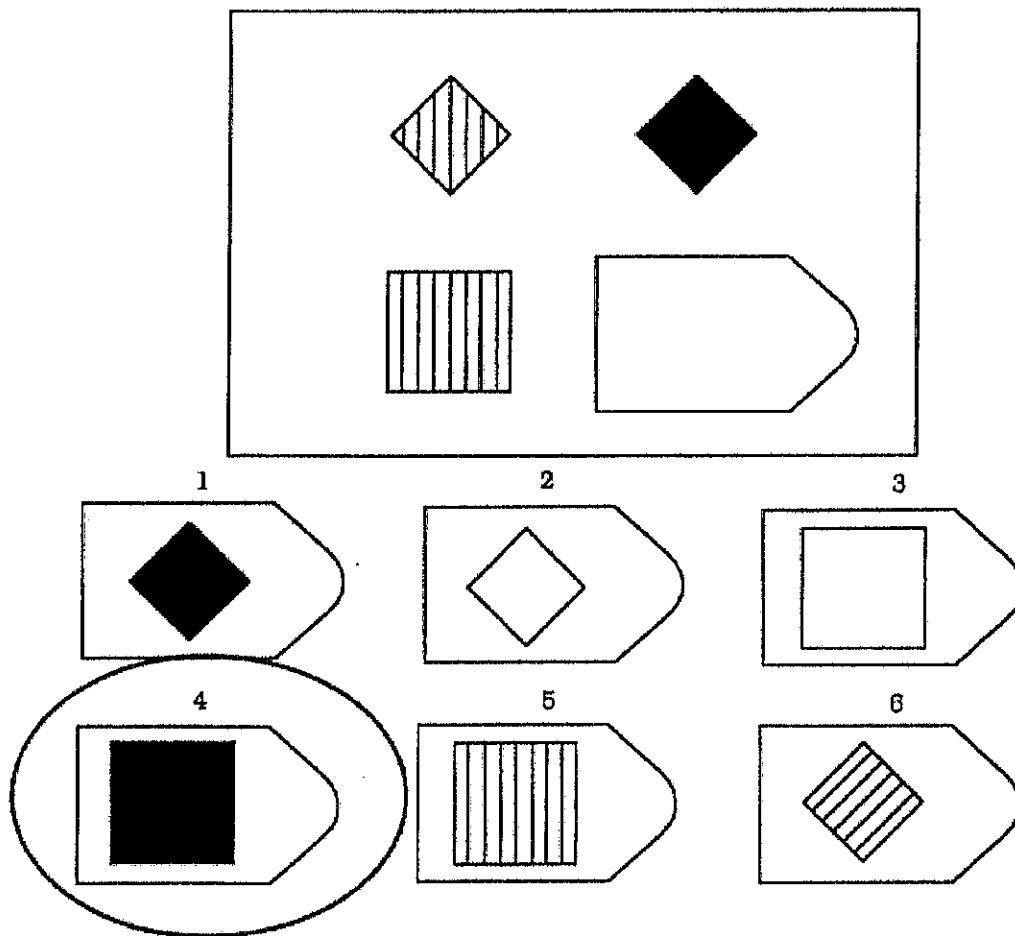




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

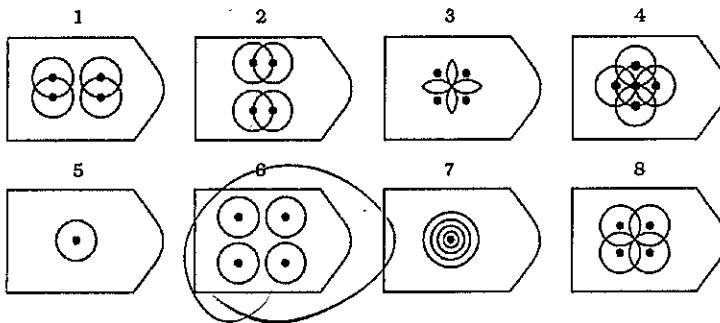
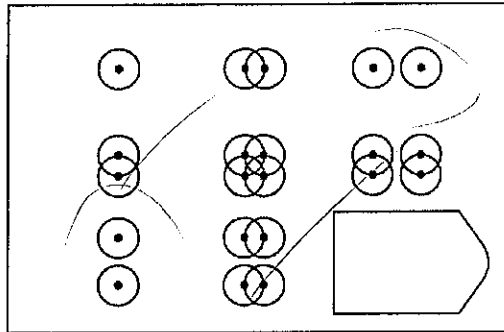


**Answer: 4**

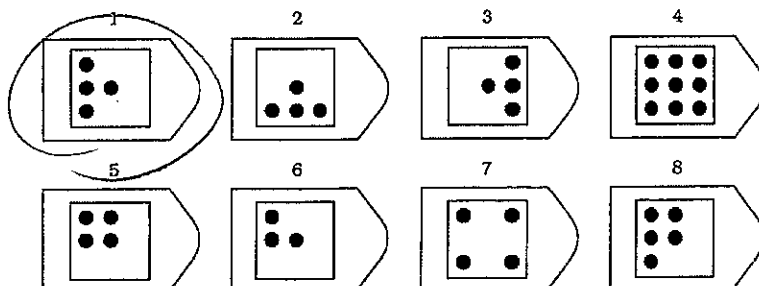
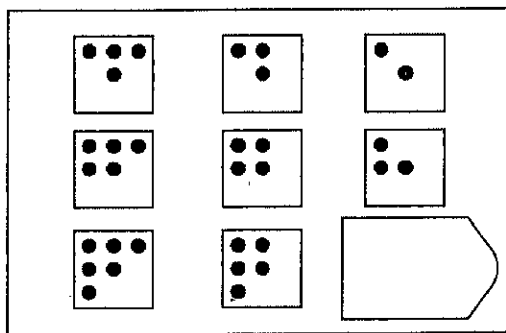
PLEASE CONTINUE ON NEXT PAGE

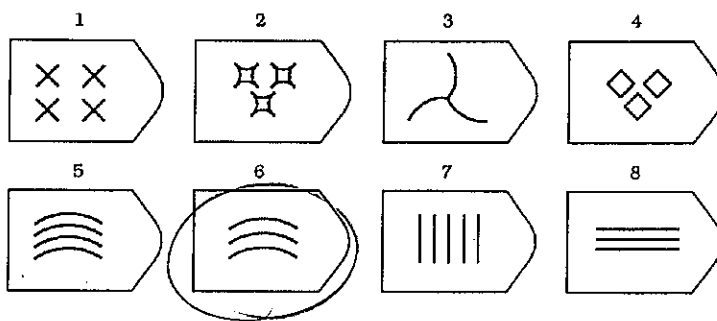
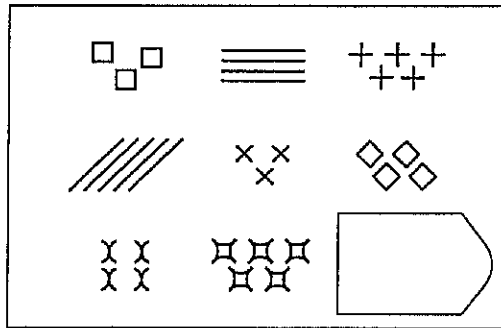
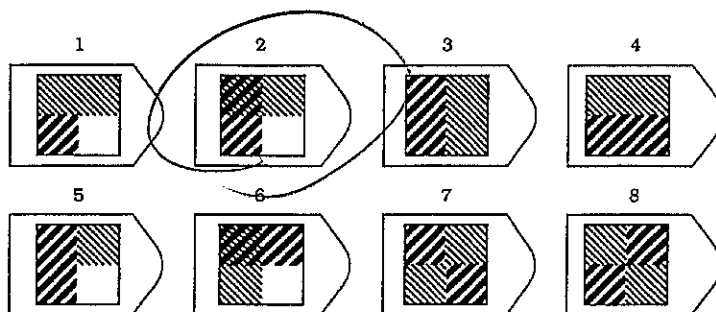
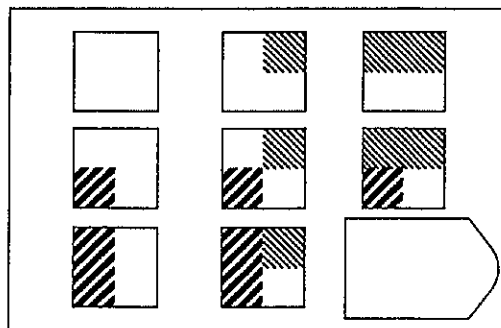
Please choose the image that best completes each of the following patterns.

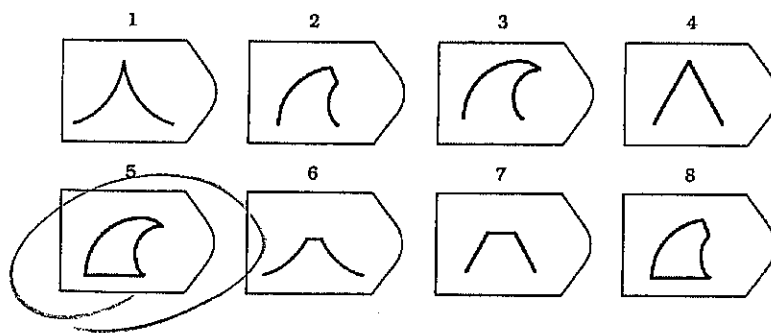
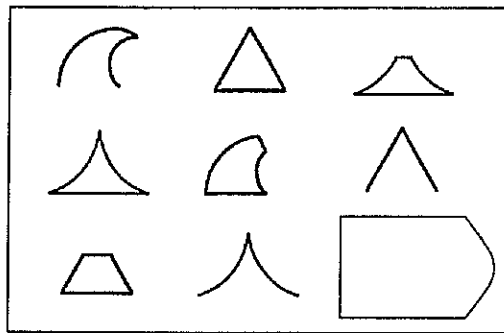
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

A. While debugging their broken firewall, a programmer came across top-secret CIA files.

☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.

C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.

D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.

B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.

C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.

D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

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B. Bob was able to maximize his work time by cutting back on watching TV during the day.

C. Sean has been closely monitoring his eating in an attempt to improve his diet.

☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

A. After eating a big lunch, Dan went back to his office and took a nap.

☒ B. When the debate went badly, Ann decided to put more time into developing convincing arguments.

C. Once he saw everyone else's formal suits, Dan went home to change clothes.

D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- ☒ E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48067

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42833012

GROUP: T14

Version A

**MULTIPLE-CHOICE. 5 points each (50 points total).**

B

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- ☐ a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - ☐ c. The surrounding crust becoming hotter
  - ☐ d. Crystals forming in the magma

D

2. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ d. An increase in desert formation resulting in more dusting blowing into the atmosphere

A

☒ Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- ☒ a. A= erosion, B= deposition, C= uplift and erosion
- b. A = erosion, B= biochemical precipitation, C= uplift and deposition
- c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
- d. A = dissolution, B= deposition, C= uplift and deposition

A

- ☒ Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
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C

- ☒ Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

B

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

$$\frac{10}{2} \quad \frac{5}{2}$$

- B
7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
- B
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- A
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

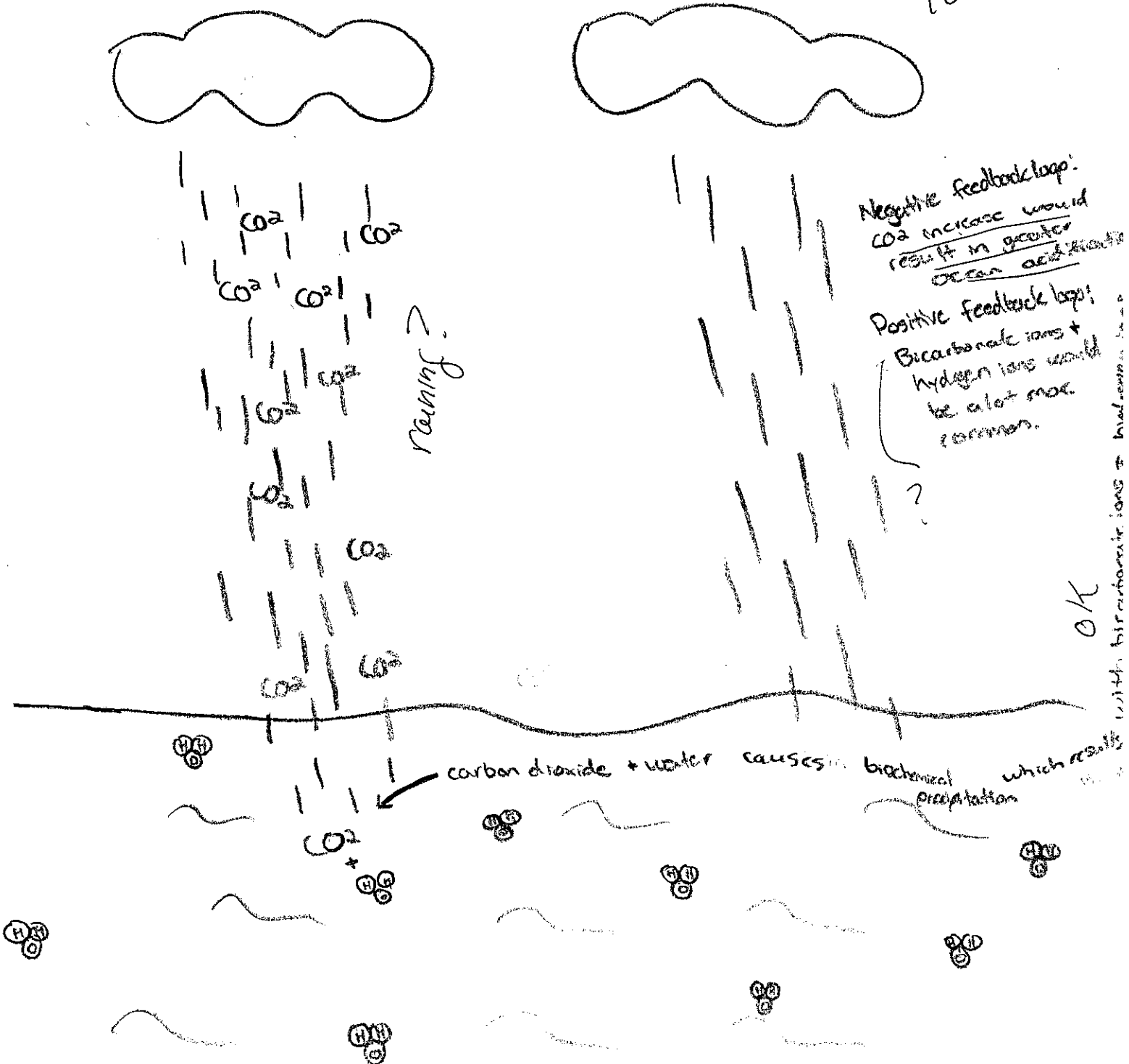


SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
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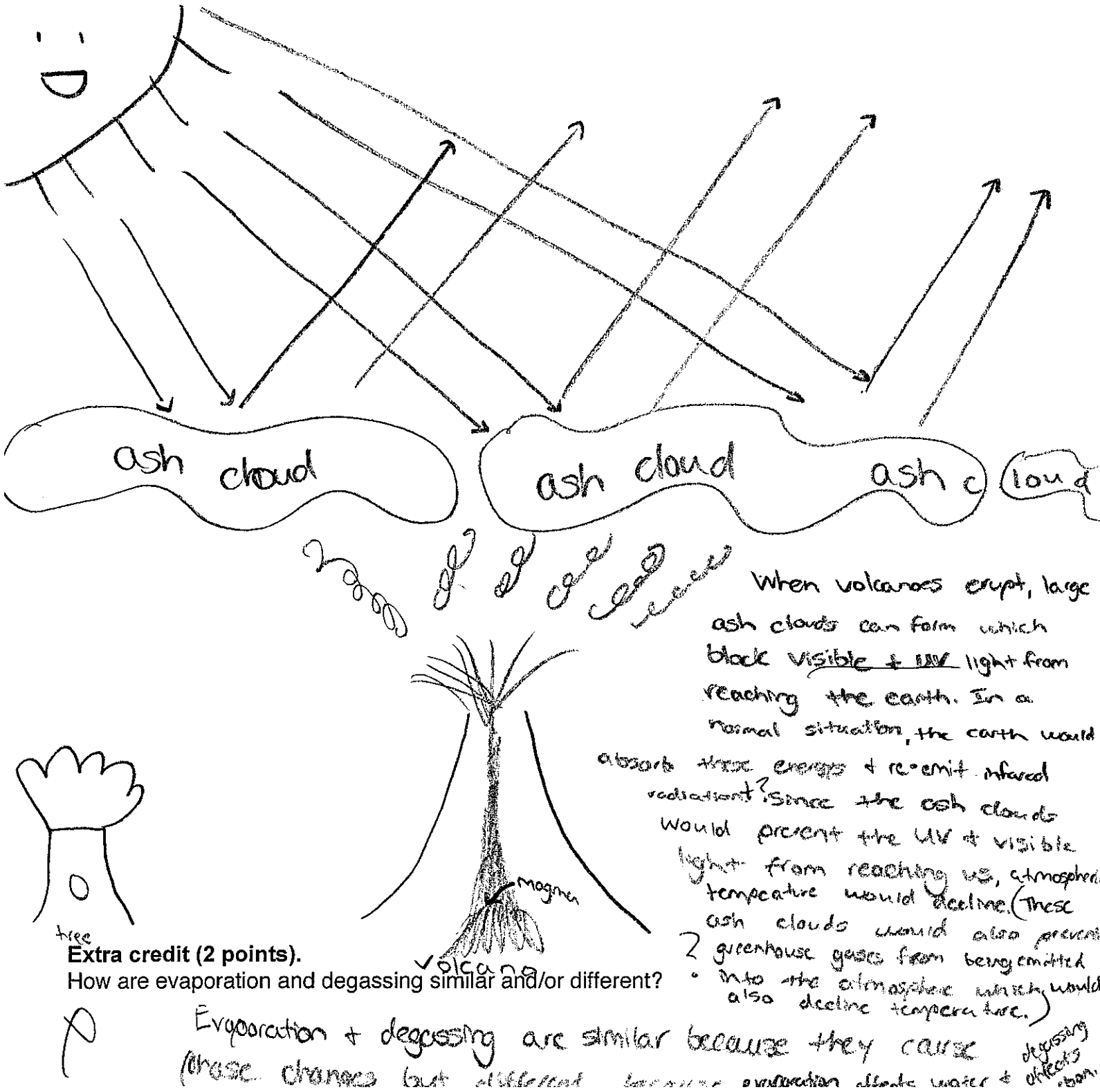


2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

15



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

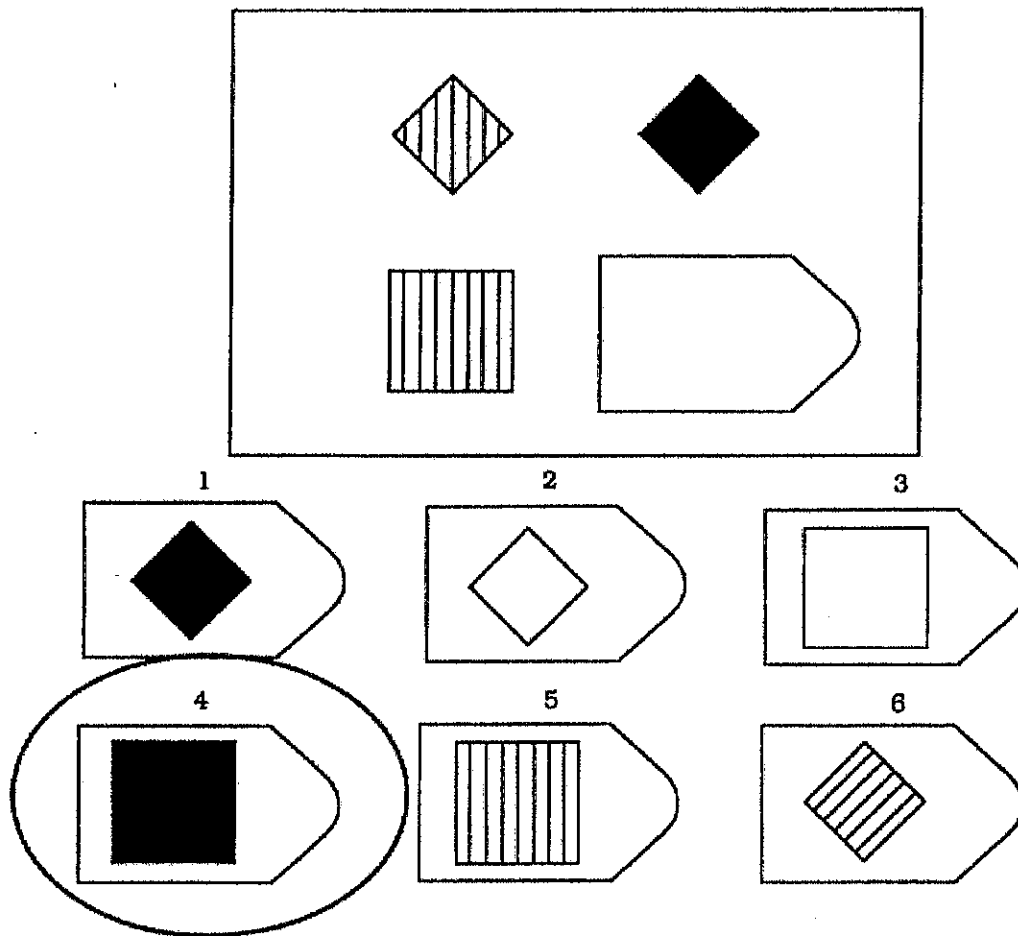
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

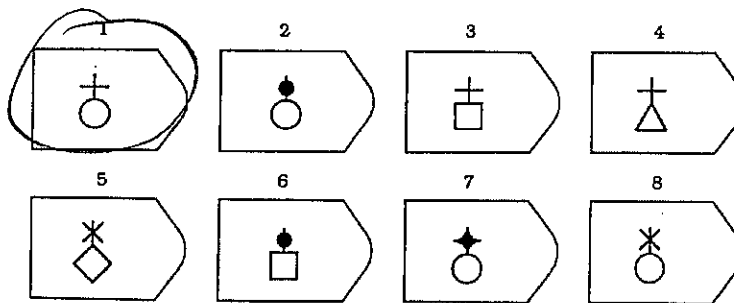
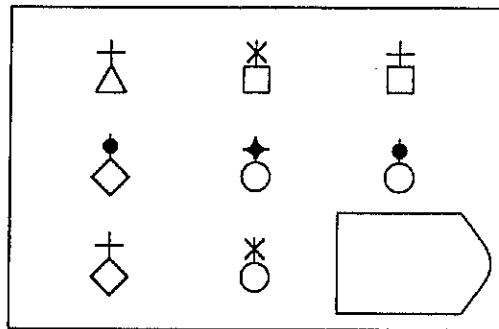


Answer: 4

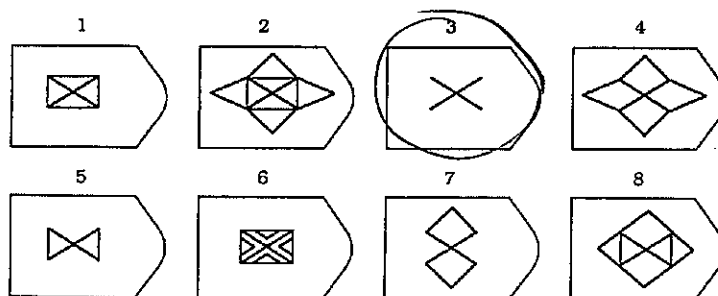
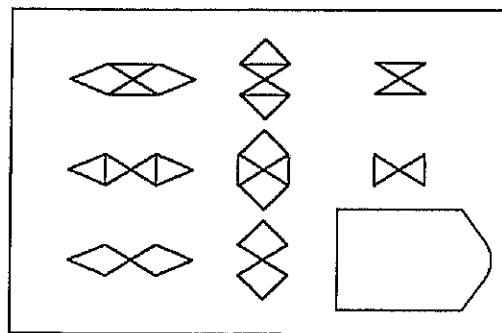
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Please choose the image that best completes each of the following patterns.

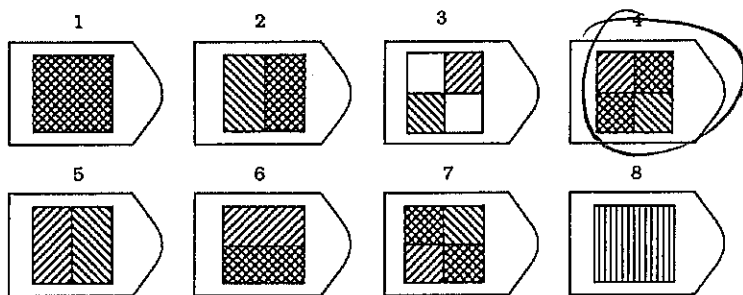
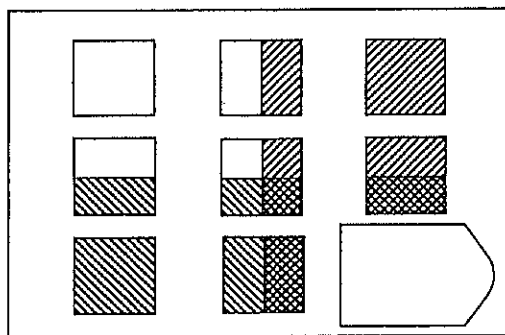
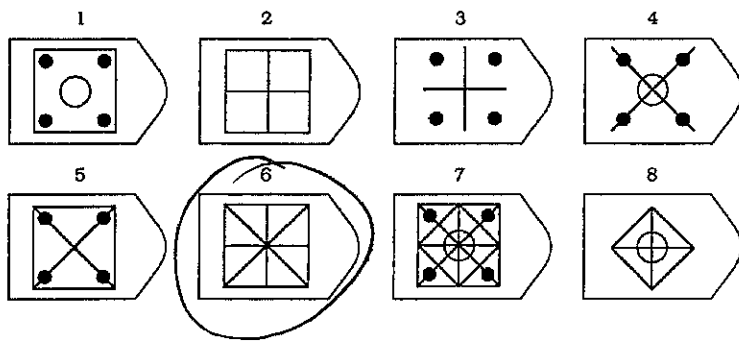
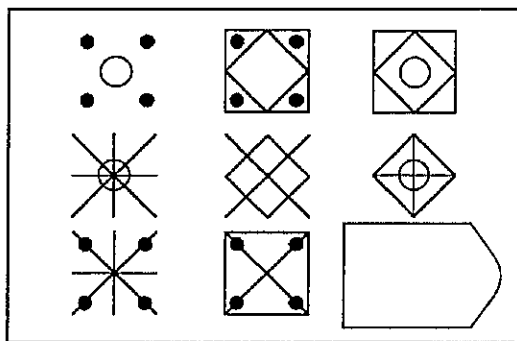
### PATTERN 1



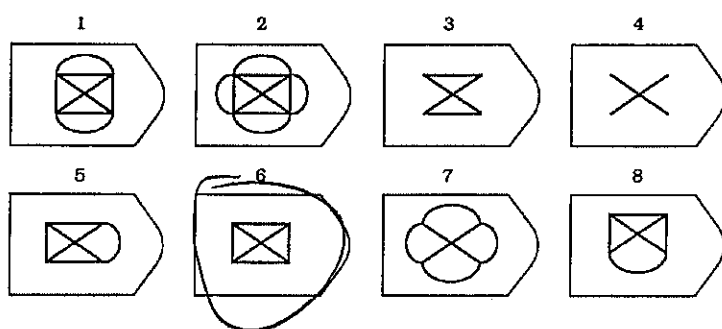
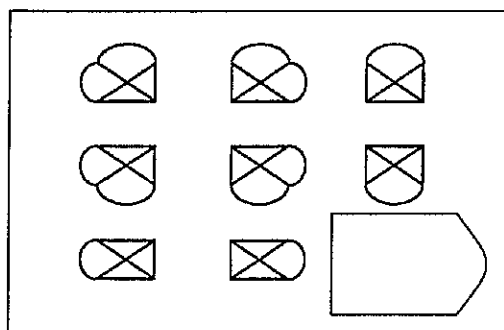
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

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- B
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2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

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  - ☐ C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
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4. The rival gangs used graffiti to define their territorial boundaries.

- C
- ☐ A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - ☐ B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
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PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
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- ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

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2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- ☒ B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48357

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A42669593  
Version A

GROUP: T14

62

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma

☒ 2. Which of the following would be considered a negative feedback to increasing global temperature?

- C
- ☒ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere

☒ 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- a
- ☒ a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- B
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - ☒ d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - ☒ e. The human and natural causes of the greenhouse effect are not understood.

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- a
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- B
- a. Reservoir A has a shorter residence time than Reservoir B. ☒
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A. ☒
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- ☐ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☐ c. The reservoir is growing smaller.
  - ☐ d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- a
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☐ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - ☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ☐ c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☐ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - ☐ b. The Earth's atmosphere would become warmer than it is today.
  - ☐ c. The Earth's atmosphere would remain about the same temperature as it is today.
  - ☐ d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

Ocean acidification is the concentration of hydrogen <sup>(+HCO<sub>3</sub><sup>-</sup> + H<sup>+</sup>)</sup> bicarbonate ions in the ocean:  $\text{CO}_2 + \text{H}_2\text{O} \rightarrow \text{HCO}_3^- + \text{H}^+$   
 An increase of carbon dioxide <sup>in the atmosphere</sup> would lead to more carbon in the ocean, which would lead to more  $\text{HCO}_3^- + \text{H}^+$  being created which increases ocean acidification, this is an example of a positive feedback loop. On the other hand a negative feedback loop is that more carbon dioxide in the atmosphere would increase the ocean temperature. An increase of oceanic temperature means that it can hold less carbon, compared to when it is a cooler temperature, so less  $\text{HCO}_3^- + \text{H}^+$  would be formed.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The dramatic increase of volcanism causing large ash clouds to erupt would initially cause the Earth's temperature to decrease.

Temperature would decrease because the clouds would block visible energy that is emitted from the sun from entering into the Earth's atmosphere. At the same time the ash clouds would also block the energy from being reflected back into space allowing the greenhouse gases to trap it, which would increase temperature. Eventually ash clouds would settle allowing the Earth to normalize itself.

greenhouse?

5

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is the transformation of a liquid into a gas.  
Degassing is movement of a gas from liquid to the air.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

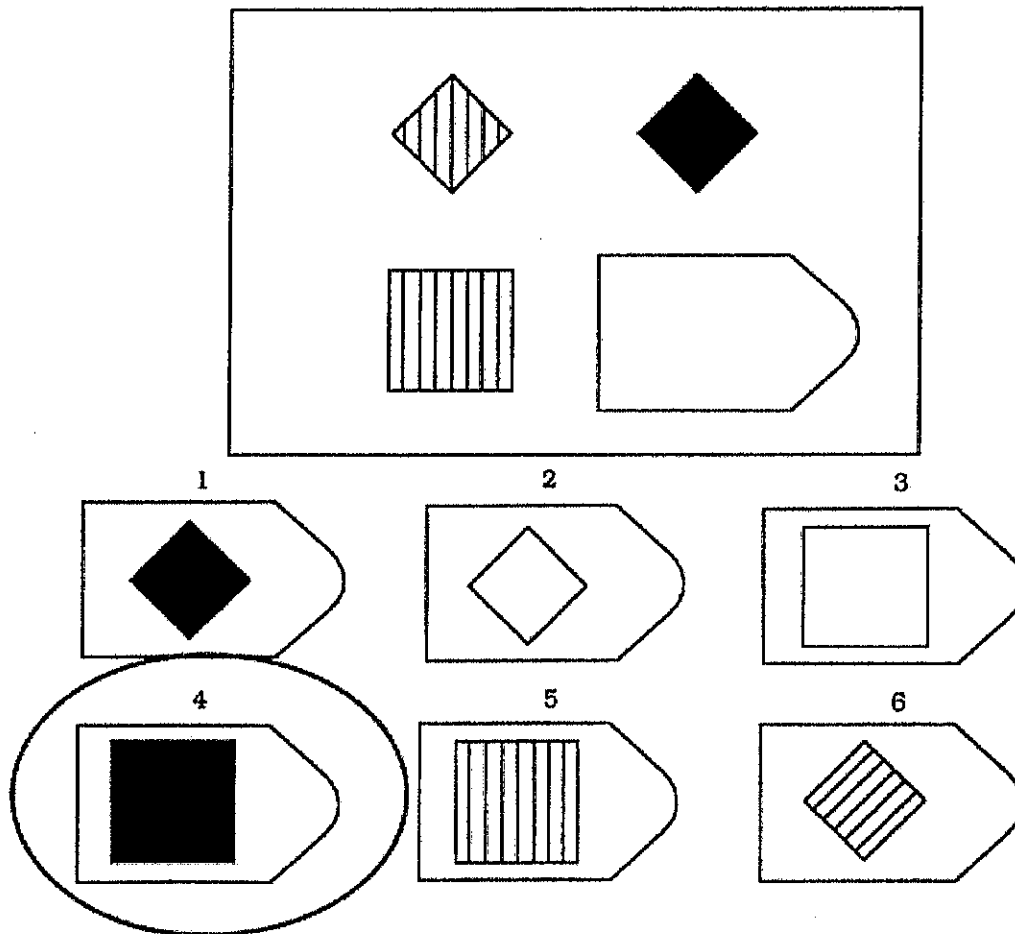




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

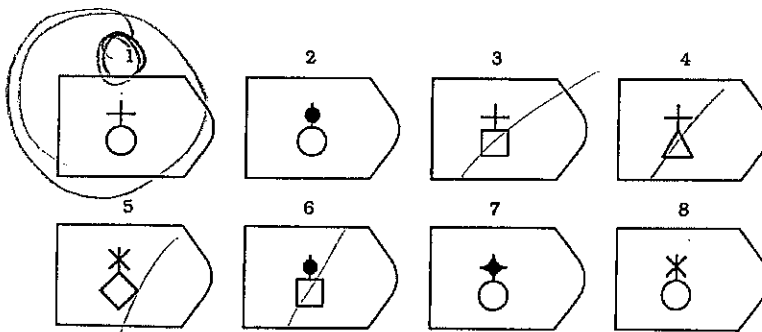
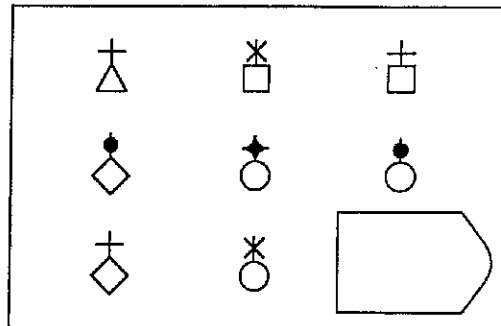


Answer: 4

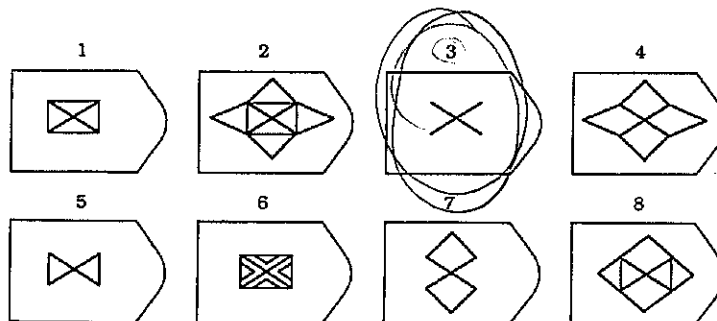
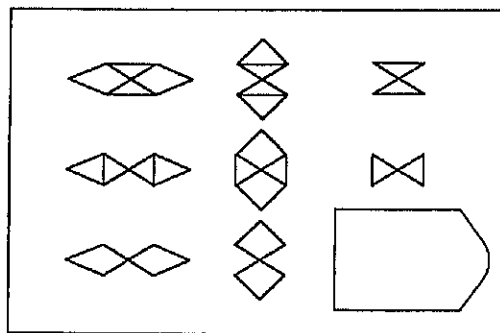
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Please choose the image that best completes each of the following patterns.

### PATTERN 1

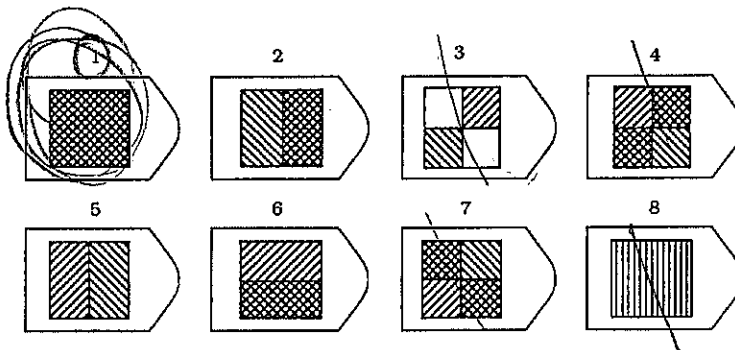
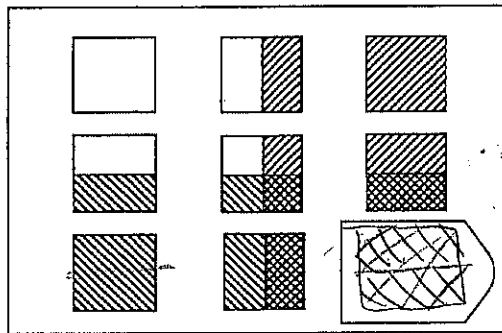


### PATTERN 2

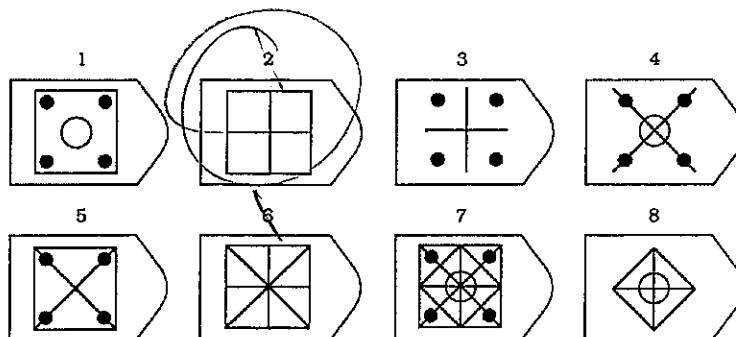
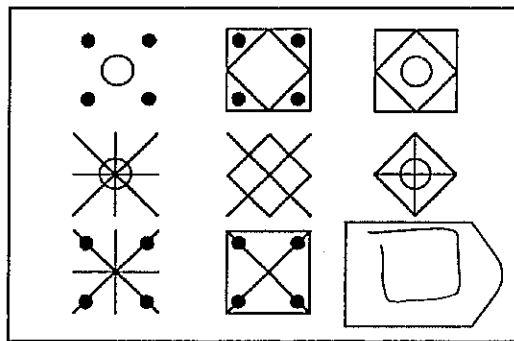


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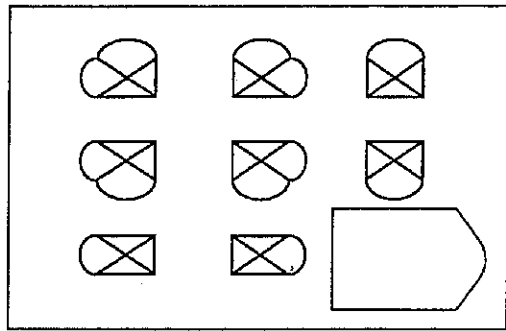
## PATTERN 3



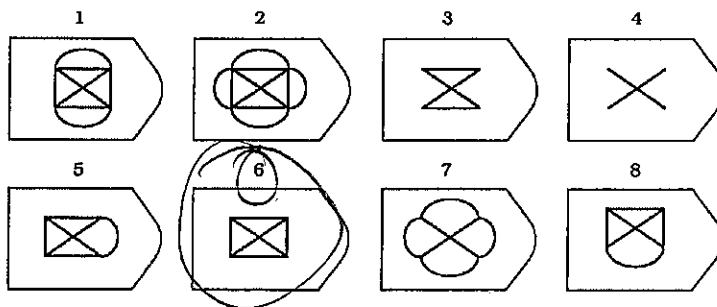
## PATTERN 4



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

6



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

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PLEASE CONTINUE ON NEXT PAGE

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Please choose the response that is closest to an analogy that you might make.

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- ☐ A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
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☐ Male  
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☐ African American/Black  
☒ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A43637189  
Version A

GROUP: T14

48

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
B a. The magma becoming colder  
b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter  
d. Crystals forming in the magma
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
C a. ~~A=erosion~~, B=deposition, C=uplift and erosion  
b. ~~A=erosion~~, B=biochemical precipitation, C=uplift and deposition  
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B a. Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.



7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- ~~a. The reservoir will eventually disappear.~~
  - ☒ b. The reservoir is not in equilibrium.
  - ~~c. The reservoir is growing smaller.~~
  - d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- C
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - ☒ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

☒ 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- D
- 43637194
- ~~a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.~~
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - ~~c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.~~
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- B
- a. The Earth's atmosphere would become colder than it is today.
  - ☒ b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.



A43637189

SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

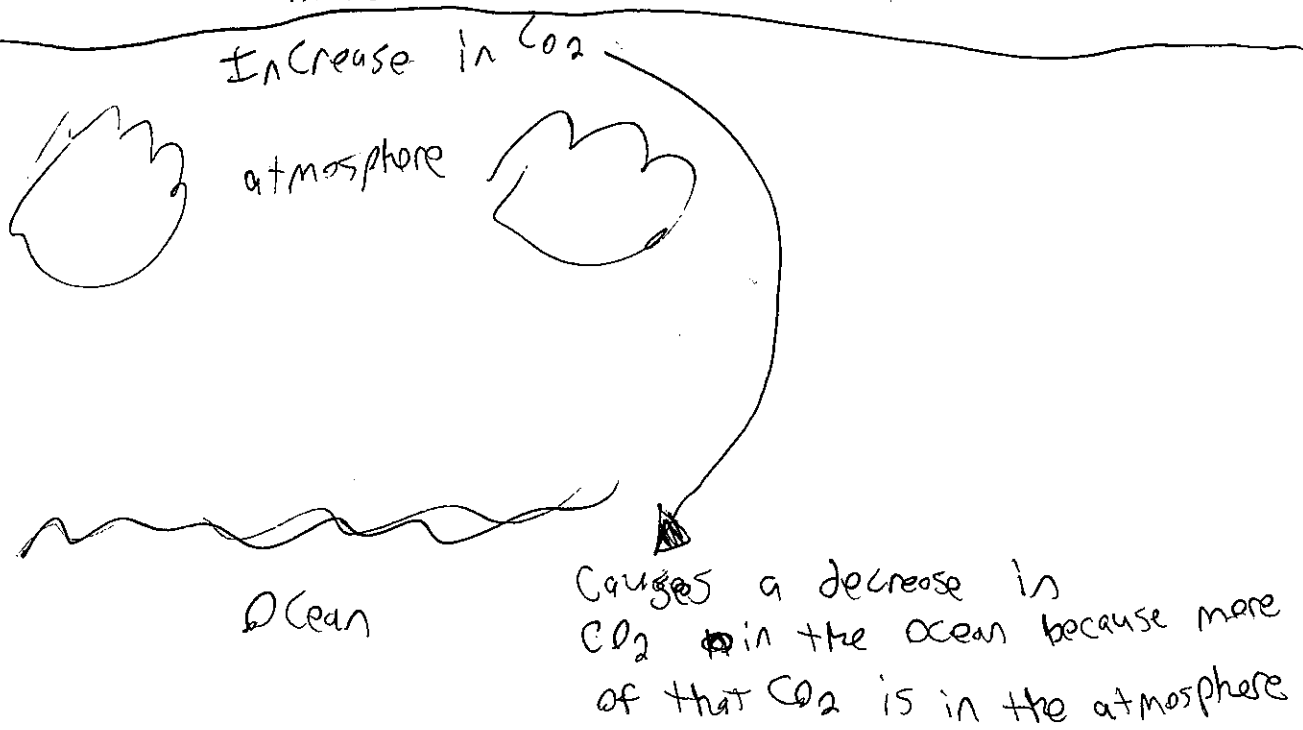
- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

1

A. An increase in atmospheric  $\text{CO}_2$  would cause a decrease in oceanic  $\text{CO}_2$ . Less  $\text{CO}_2$  in the oceans would mean that ocean acidification would decrease.

B. Pos. Feedback: The temperature of the water would increase + ?

Neg. Feedback: more acidic oceans are a worse environment for ocean life, ~~also~~ <sup>also</sup> the atmospheric temp would increase



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

2

A. Large ash clouds would cause less visible light from the sun to reach Earth's surface, but it would also cause more infrared from Earth's surface & the greenhouse effect to be absorbed into the atmosphere. The greenhouse effect is plants absorbing visible light from the sun (since the atmosphere does not absorb visible light) and converting it into infrared light, which the atmosphere does absorb. ~~the atmosphere~~

B. Because an increase in the greenhouse effect causes an increase in atmospheric temperature, ~~and~~ large volcanic ash clouds would help the atmosphere trap more infrared energy, Earth's atmospheric temperature would ~~decrease~~ increase. This ~~decrease~~ increase would be less significant because the ash clouds would also slightly decrease visible light from the sun that reaches Earth's surface.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation & degassing are similar in that both processes involve the heating of something that results in it gravitating up into Earth's atmosphere. They are different because evaporation = water & degassing = gases.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

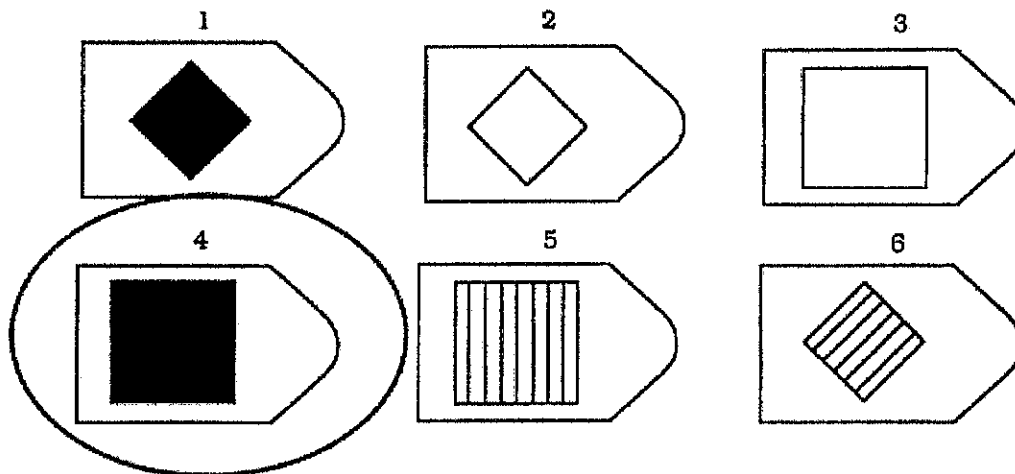
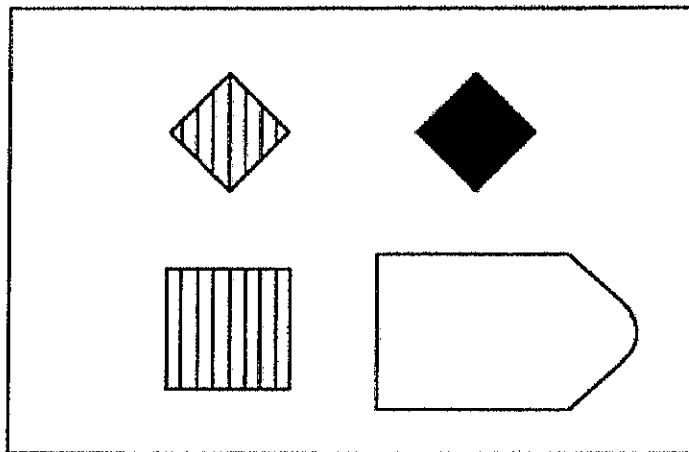
#4363789



# Analogical Assessment

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*Example*

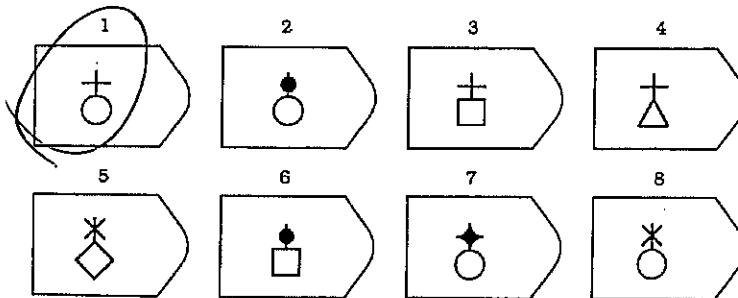
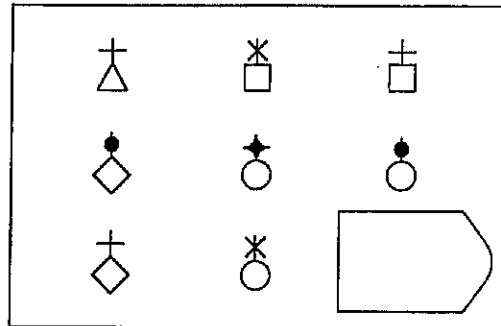


Answer: 4

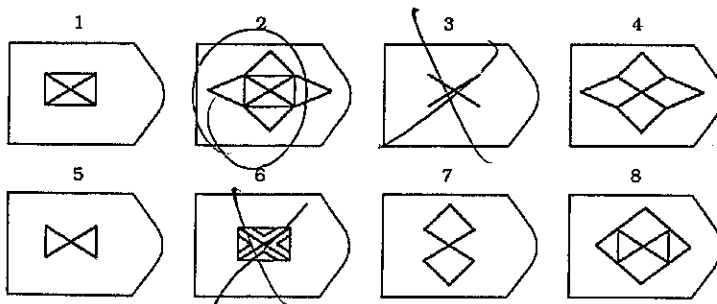
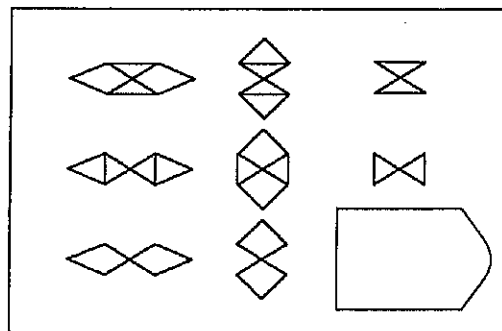
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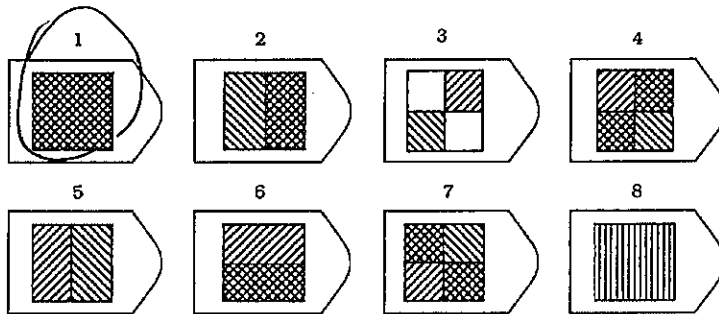
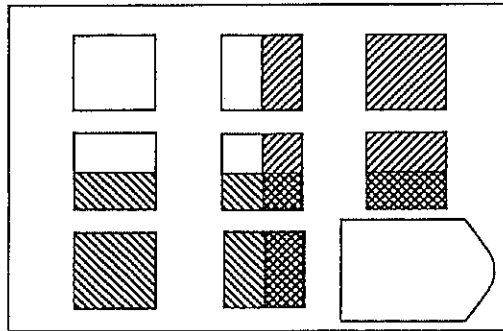
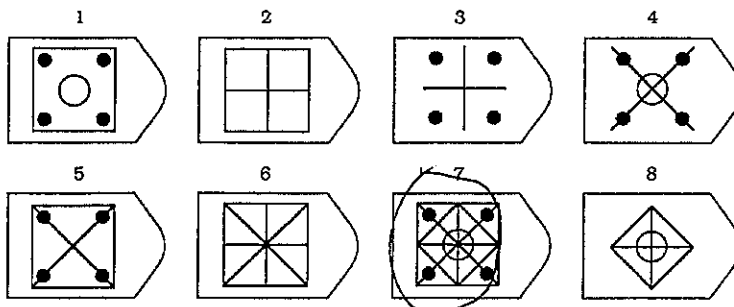
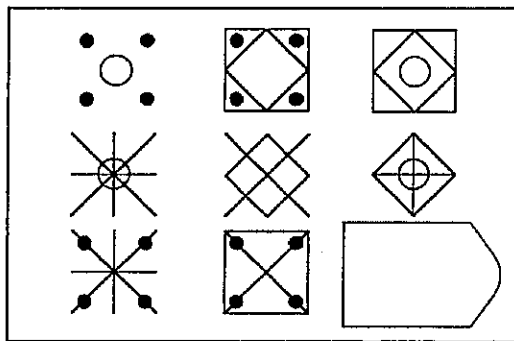
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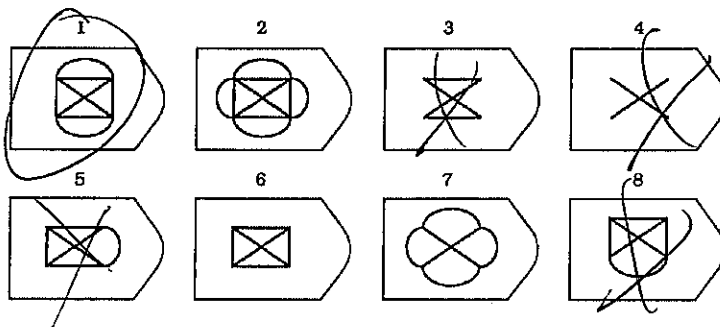
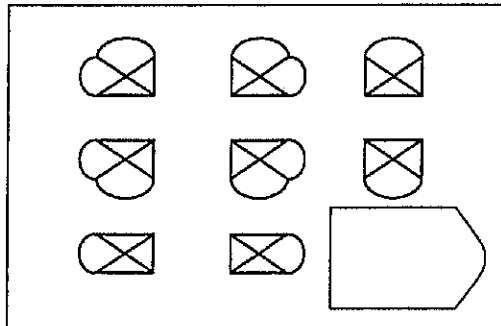
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PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

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Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



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- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
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- ☒ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
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- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

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- B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- A. Getting the flu. They are similar because they are both caused by viruses.
- ☒ B. Getting pink eye. They are similar because they are both contagious.
- ~~C. Getting the flu. They are similar because they are both caused by not washing your hands.~~
- ~~D. Forgetting to do your homework. They are similar because they are both preventable.~~
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 18 years

What is your home zip code? 48164

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☒ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A41107889  
Version A

GROUP: T14

82

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?

- B
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma

2. Which of the following would be considered a negative feedback to increasing global temperature?

- B
- ~~a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed~~
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ~~c. An increase in evaporation and cloud formation resulting in the release of latent heat~~
  - ~~d. An increase in desert formation resulting in more dusting blowing into the atmosphere~~

3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.

- C
- ~~a. A= erosion, B= deposition, C= uplift and erosion~~
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - ~~d. A = dissolution, B= deposition, C= uplift and deposition~~

4. Which of the following statements about the greenhouse effect on Earth is most accurate?

- B
- ~~a. Human activities are the primary cause of the greenhouse effect.~~
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - ~~c. Human activities and natural processes are roughly equal causes of the greenhouse effect.~~
  - ~~d. Neither human activities nor natural processes are important causes of the greenhouse effect.~~
  - ~~e. The human and natural causes of the greenhouse effect are not understood.~~

5. Which of the following would cause the acidity of Earth's oceans to decrease?

- A
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ~~c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.~~

6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?

- B
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- B
- ☒ a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - ☒ c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.

8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- B
- ☒ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - ☒ d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric  $\text{CO}_2$  would at first increase ocean acidification. The ocean would absorb more  $\text{CO}_2$  and according to the equation  $\text{CO}_2 + \text{H}_2\text{O} \rightleftharpoons \text{HCO}_3^- + \text{H}^+$  would lower the ocean's pH, or increase its acidity, this negative feedback. Over time, a positive feedback loop would come into play when the ocean heats up from the increase in atmospheric temperature due to the increase of the greenhouse gas  $\text{CO}_2$ . This would cause less  $\text{CO}_2$  to be absorbed by the ocean water, because when water heats up it has less room to absorb gas molecules due to the faster moving particles in the water. Which in turn would mean that more  $\text{CO}_2$  has to stay in the atmosphere which would cause further heating thus demonstrating a positive feedback loop.

25

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

An increase in volcanic eruptions leading to more volcanic ash in the atmosphere would decrease the earth's atmospheric temperature. This would occur because when the sun's radiation enters the atmosphere, it enters as visible light and ultraviolet light. This accumulation of volcanic ash would block a majority of the visible light entering the earth's atmosphere. This in turn would decrease the amount of light being reflected off earth's surface as infrared light which interacts with greenhouse gases in earth's atmosphere, where they are reflected back, thereby warming the atmosphere. So a deficit in these infrared rays would lead to the cooling of the atmosphere. This is much similar to the idea of a nuclear winter.

20

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are similar because they both involve liquids and gases. They differ in that evaporation is moving from a liquid state to a gaseous state, and degassing is the release or movement of a gas out of a liquid.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

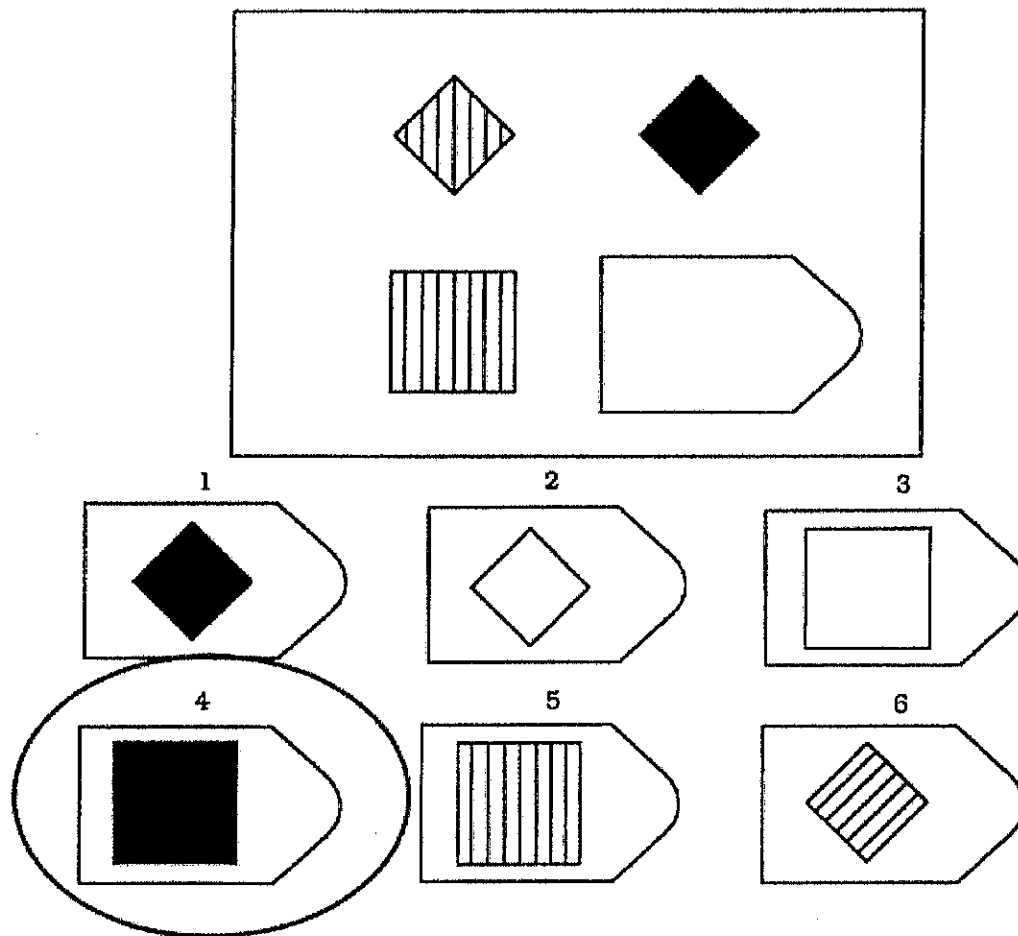




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In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

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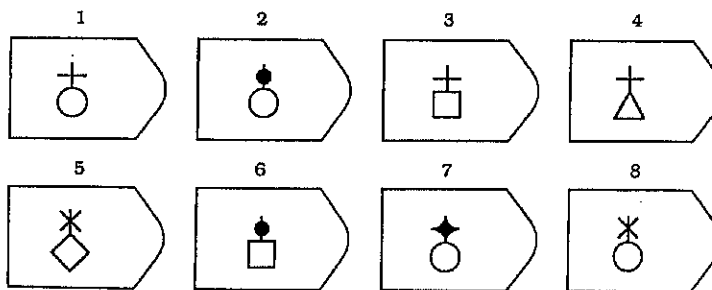
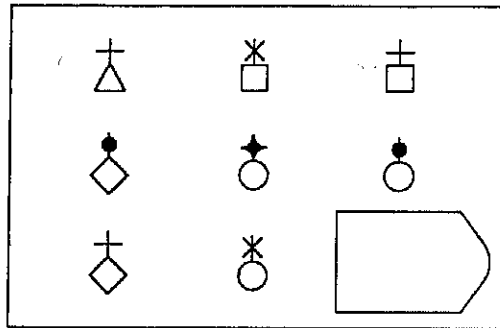


**Answer: 4**

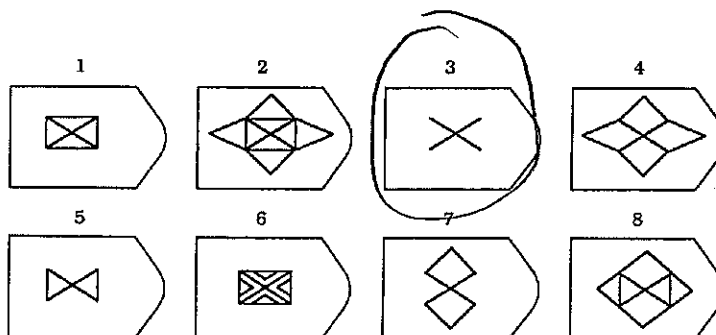
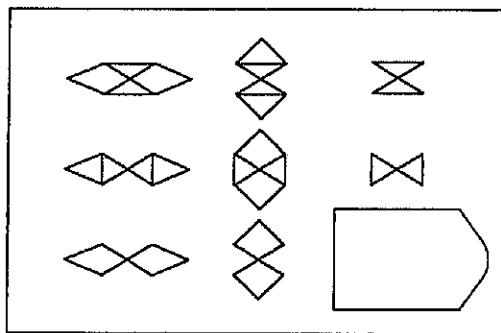
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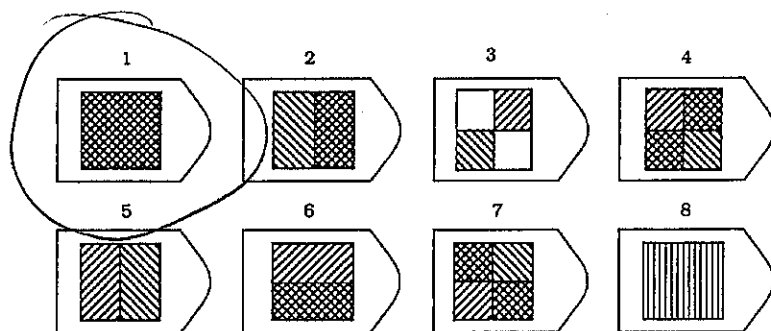
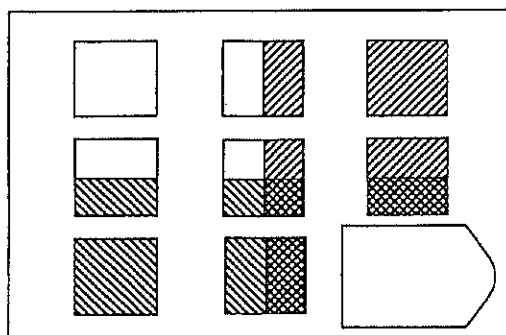
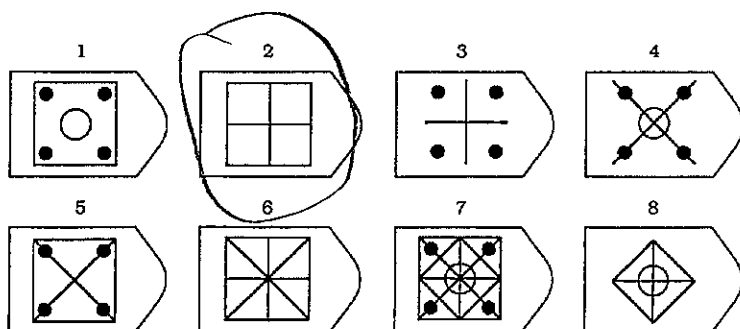
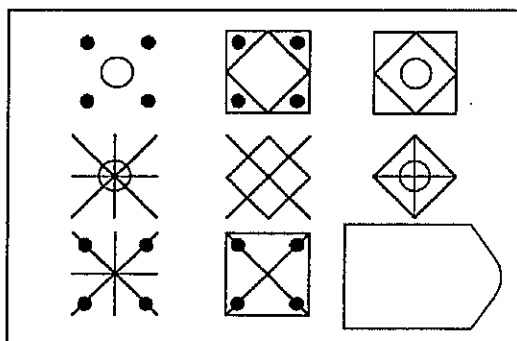
### PATTERN 1



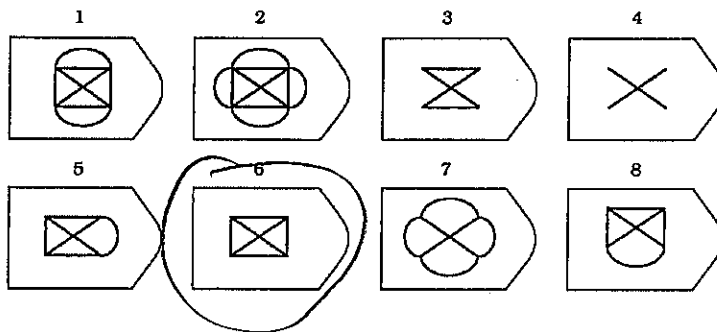
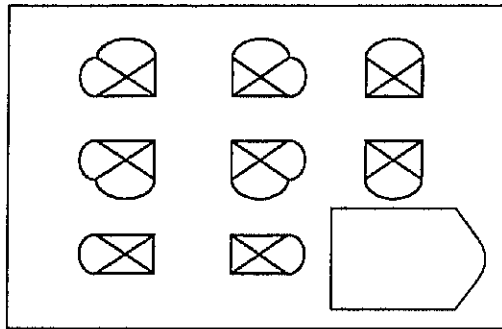
### PATTERN 2



PLEASE CONTINUE ON NEXT PAGE

**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

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**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE

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☐ E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

### DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48375

What is your gender?

☒ Male

☐ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

STUDENT NAME: A34590917  
Version B

GROUP

T15

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?  
a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed  
b. ☒ Melting of permafrost resulting in more methane escaping into the atmosphere  
c. An increase in evaporation and cloud formation resulting in the release of latent heat  
d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?  
a. The magma becoming colder  
b. Gas bubbles forming in the magma  
c. The surrounding crust becoming hotter  
d. ☒ Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.  
a. A= erosion, B= deposition, C= uplift and erosion  
b. A = erosion, B= biochemical precipitation, C= uplift and deposition  
c. A= dissolution, B= biochemical precipitation, C= uplift and erosion  
d. ☒ A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?  
a. Human activities are the primary cause of the greenhouse effect.  
b. Natural processes are the primary cause of the greenhouse effect.  
c. ☒ Human activities and natural processes are roughly equal causes of the greenhouse effect.  
d. Neither human activities nor natural processes are important causes of the greenhouse effect.  
e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?  
a. ☒ Reservoir A has a shorter residence time than Reservoir B.  
b. Reservoir B has a shorter residence time than Reservoir A.  
c. Reservoir A and Reservoir B have equal residence times.  
d. More information about Reservoir A and Reservoir B is needed.
6. Which of the following would cause the acidity of Earth's oceans to decrease?  
a. ☒ An increase in ocean temperature due to an increase in atmospheric carbon dioxide.  
b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.  
c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- B
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- A
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.
9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- A
- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - b. Reflection of more solar radiation, causing atmospheric temperature to increase
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10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- C
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
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**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would cause the temperature of the ocean to increase ~~because~~ the carbon dioxide which is present in the air would dissolve into the ocean therefore causing the acidity level of the ocean to drop and decrease.

A negative <sup>feedback</sup> would involve the melting of glaciers and ice sheets due to the temperature increase of the ocean. A positive feedback would involve the acidity levels becoming extremely <sup>too</sup> high due to an increase in carbon dioxide and solar radiation from the sun.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

If volcanism on earth were to suddenly increase, this would cause the earth's atmospheric temperature to decrease. This would occur due to the eruption of large ash clouds that would block solar radiation emitted by the sun. The blocking of sunlight would decrease the atmospheric temperature in return.

5

EXPLAIN

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

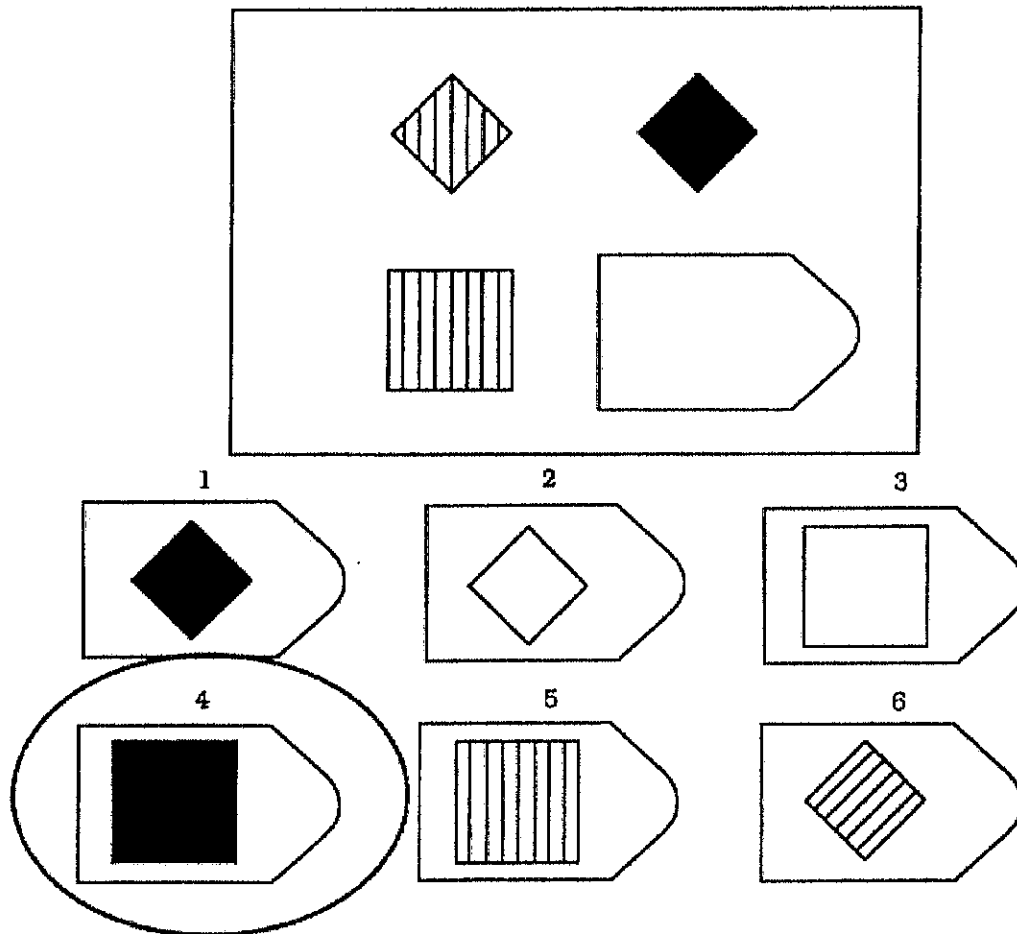


# Analogical Assessment

---

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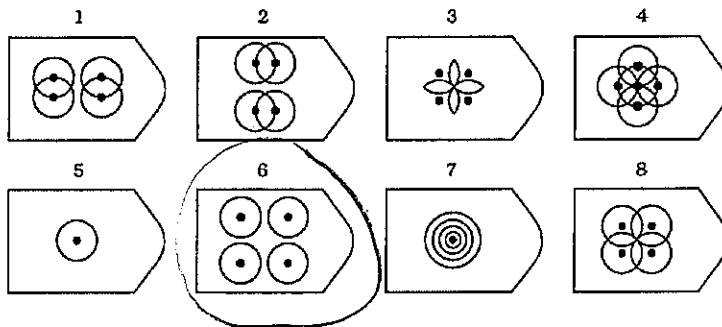
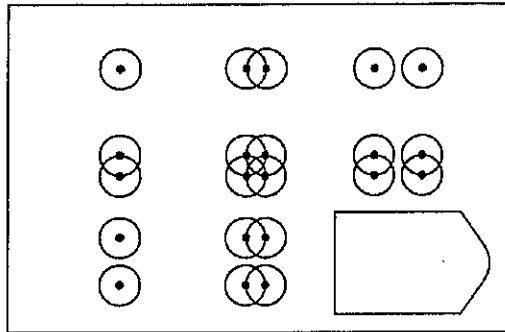


**Answer: 4**

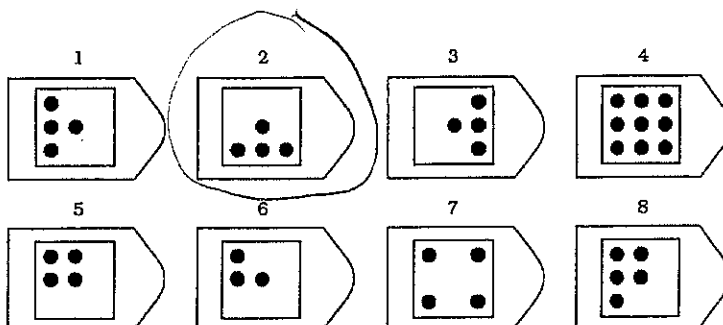
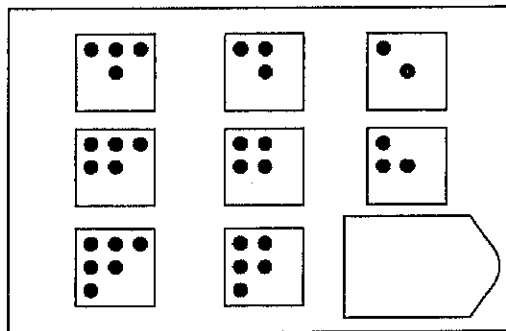
PLEASE CONTINUE ON NEXT PAGE

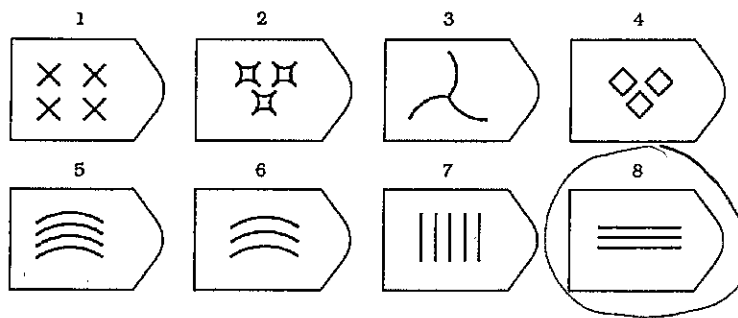
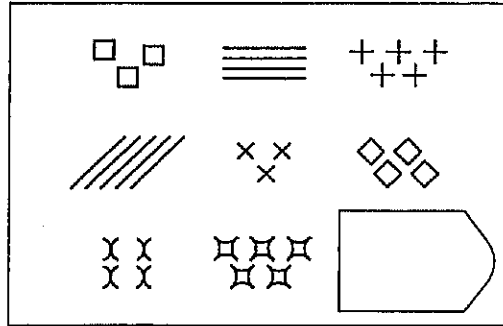
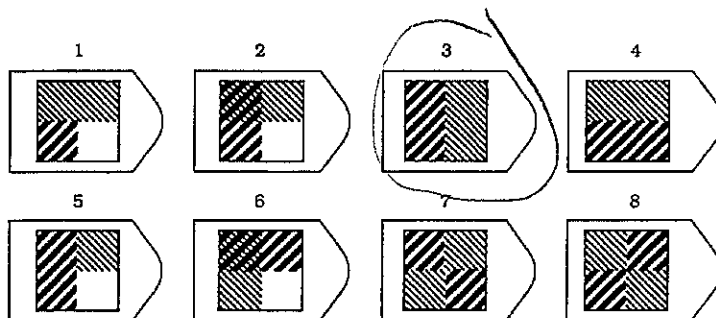
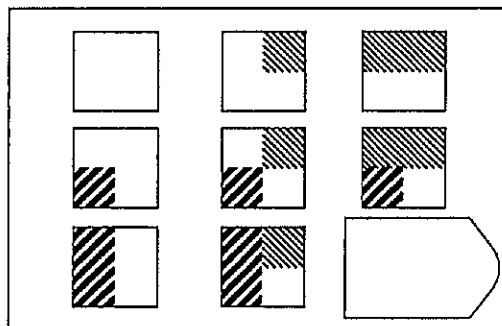
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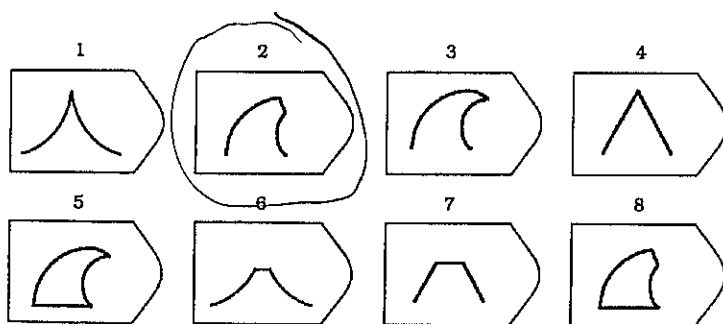
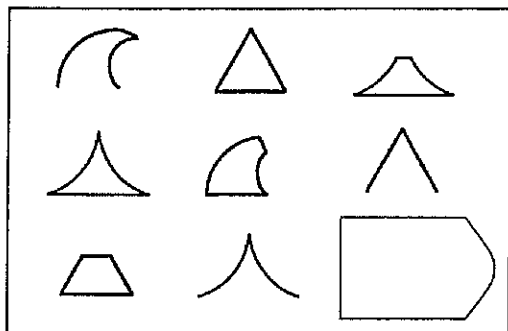
### PATTERN 1



### PATTERN 2



**PATTERN 3****PATTERN 4**

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
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PLEASE CONTINUE ON NEXT PAGE



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4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

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- ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

- B 5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.
- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
  - ☒ B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
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- 

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  - ☒ C. Being sleep deprived. They both involve impaired functions.
  - D. Eating too much candy. They both involve lack of self-control.
  - E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- B
- A. Dew forming. They are similar because they both involve a drop in temperature.
  - ☒ B. Blowing up a balloon. They are similar because they both involve becoming less dense.
  - C. Clouds forming. They are similar because they both involve a phase change.
  - D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 25 years

What is your home zip code? 49022

What is your gender?

- ☐ Male  
☒ Female  
☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black  
☐ Caucasian  
☐ Latino/Hispanic  
☐ Native Hawaiian/Pacific Islander  
☐ Native American  
☐ Other

STUDENT NAME: A43643320

GROUP: T15

Version B

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- ☐ a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☐ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
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2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
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3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
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4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - ☐ b. Natural processes are the primary cause of the greenhouse effect.
  - ☐ c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
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5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
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7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

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9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- ☒ a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
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☐ c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
☐ d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- ☐ a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
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## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

25

a)  $\text{CO}_2$  from the atmosphere is absorbed by the ocean. When  $\text{CO}_2$  enters the ocean it goes through hydration to create  $\text{H}_2\text{CO}_3$  (carbonic acid) carbonic acid then breaks down into oxycarbon ions & bicarbonate. Bicarbonate then goes to carbonate ions which can create seashells.

b) Increase in atmospheric  $\text{CO}_2$  would lead to an increase in ocean's  $\text{CO}_2$  levels meaning that the oceans acidification would increase the more  $\text{CO}_2$  that is absorbed the more acidic the water gets, this would be a positive feedback. An increase in atmospheric  $\text{CO}_2$  would also lead to an increase in temperatures which would decrease the oceans ability to absorb  $\text{CO}_2$  from the atmosphere which would cause temperatures to go up even more, this would be a negative feedback loop for ocean acidification because it would be able to absorb a lot of  $\text{CO}_2$  at first but as temperatures in the ocean & atmosphere increase it would decrease in the amount of  $\text{CO}_2$  being absorbed.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25

The greenhouse effect is trapping of heat within Earth's atmosphere due to greenhouse gases within the atmosphere. When solar radiation enters the atmosphere as light energy, the Earth's surface either absorbs or reflects it. The reflected energy escapes back to space but the absorbed heat is emitted from the Earth as infrared heat. The infrared travels into the atmosphere where it is absorbed by the greenhouse gases & then re-emitted back to the Earth. It is constantly recycled like this. If there was a volcanic eruption & ash settled in the upper atmosphere, it would block solar radiation from entering the atmosphere. This could cause great decreases in the Earth's temperature. The clouds of ash could also block heat & light energy already in the atmosphere from escaping which would mean that greenhouse gases would be emitting more heat which could increase the Earth's temperature. It would be hard to predict whether volcanic eruptions would cause an increase or a decrease in the Earth's temperatures.

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

degassing is the movement of a gas from a liquid into the atmosphere. evaporation is the phase change from a liquid to a gas. Both move from liquid to gas in the atmosphere but one doesn't undergo a phase change

A43643320

**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

5

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

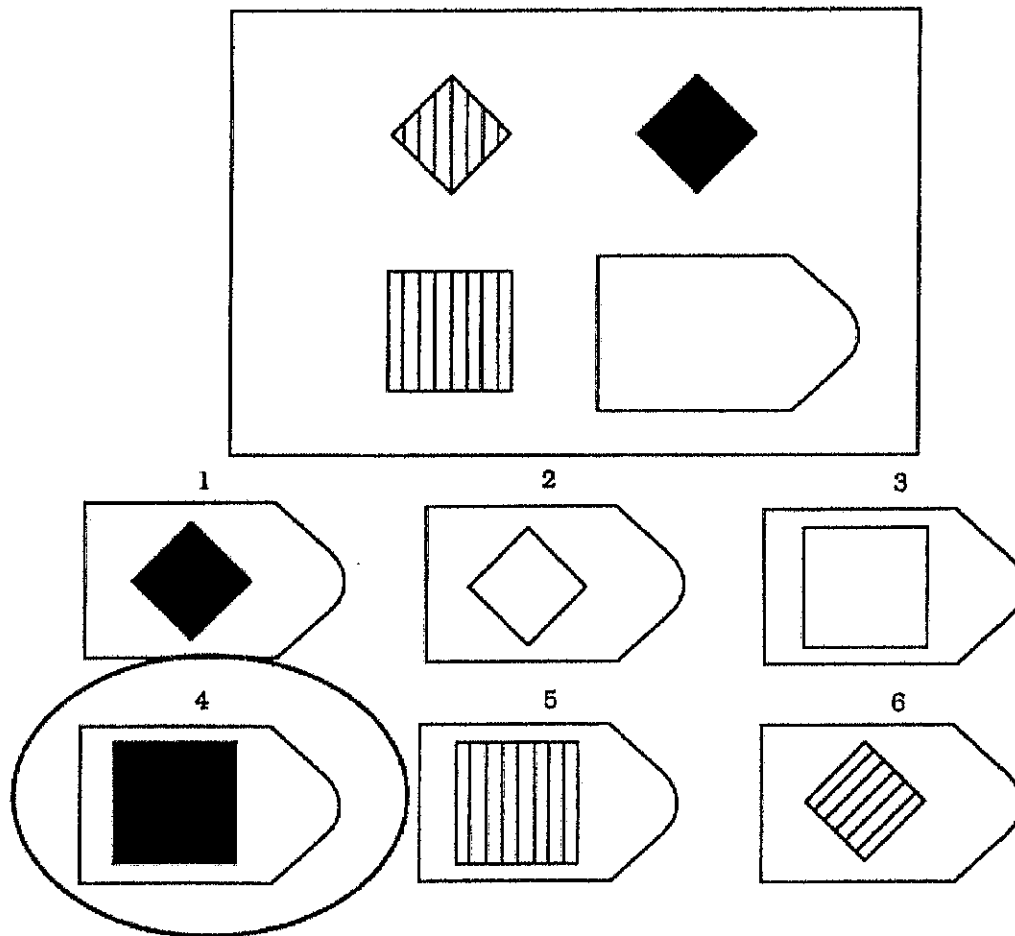




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

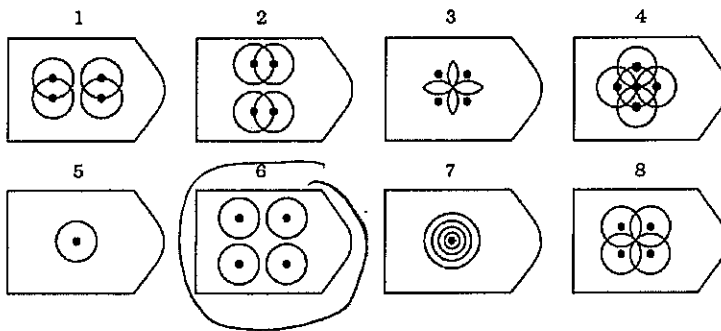
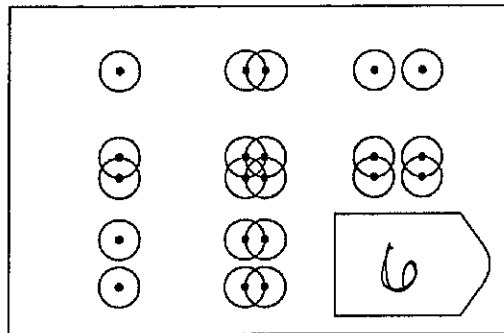


**Answer: 4**

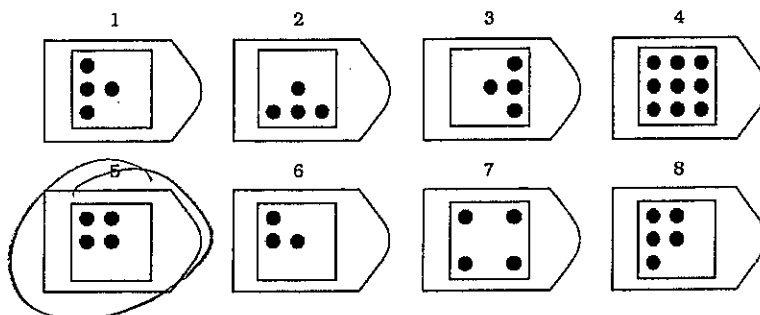
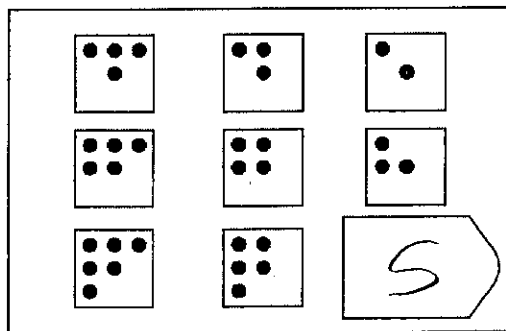
PLEASE CONTINUE ON NEXT PAGE

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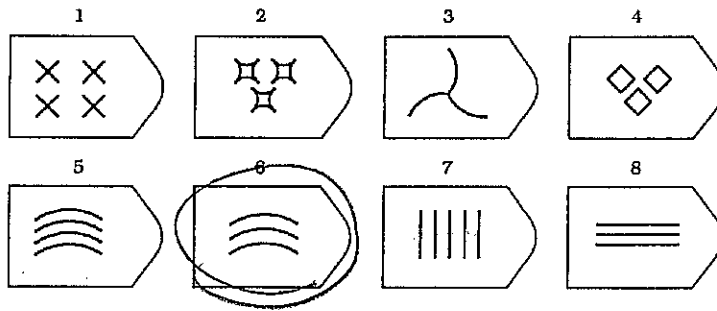
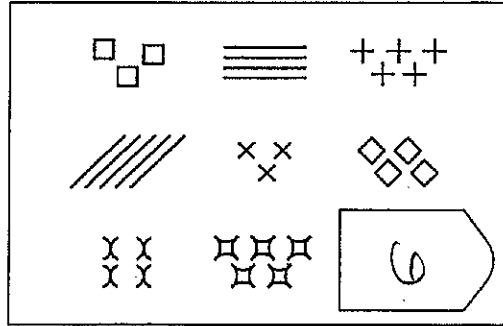
### PATTERN 1



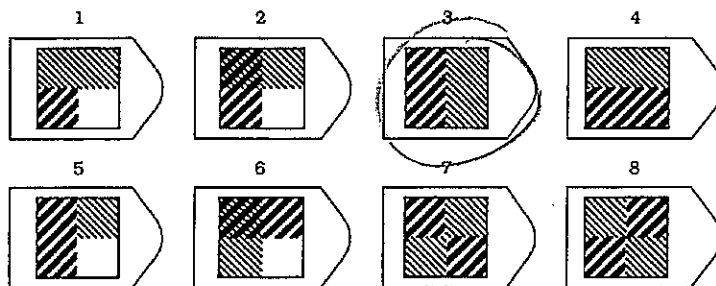
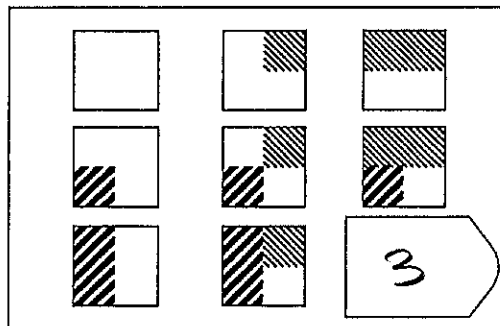
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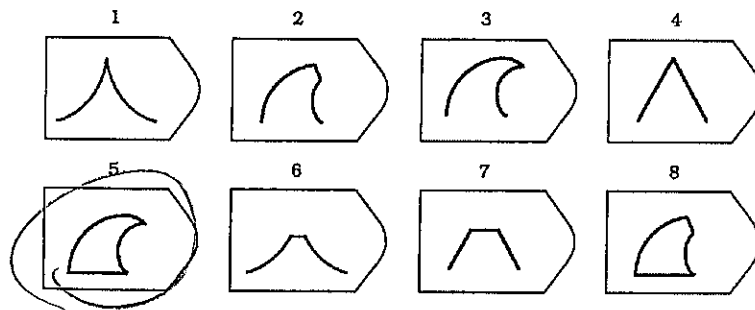
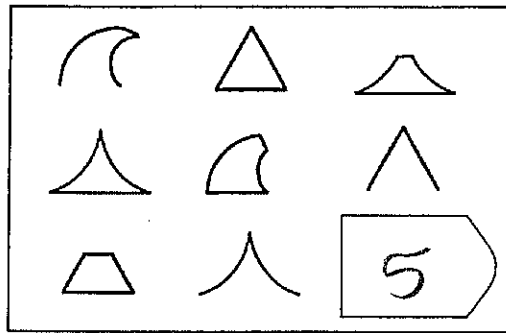


**PATTERN 3**



**PATTERN 4**



**PATTERN 5**

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**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

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PLEASE CONTINUE ON NEXT PAGE

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A. Dew forming. They are similar because they both involve a drop in temperature.

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## DEMOGRAPHICS

What is your age? 19 years

What is your home zip code? 48825

What is your gender?

☐ Male

☒ Female

☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

☐ African American/Black

☒ Caucasian

☐ Latino/Hispanic

☐ Native Hawaiian/Pacific Islander

☐ Native American

☐ Other

42 1

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A41262816  
Version B

GROUP T15

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ a. Human activities are the primary cause of the greenhouse effect.
  - b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
- ☒ b. Reservoir B has a shorter residence time than Reservoir A.
- c. Reservoir A and Reservoir B have equal residence times.
- d. More information about Reservoir A and Reservoir B is needed.
- $$A \quad rt = \frac{(2) \text{size}}{\text{rate}} = (2)5 = 10$$
$$B \quad rt = \frac{\text{size}}{\text{rate}} = 5$$
6. Which of the following would cause the acidity of Earth's oceans to decrease?
- a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

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ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.
- b. The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.

$$\begin{array}{r} 10 \\ 100 \overline{) 1000} \\ \underline{100} \phantom{0} \\ 00 \\ \underline{0} \\ 0 \end{array}$$

8. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.
- b. The Earth's atmosphere would become warmer than it is today.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

9. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

10. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.



841262816

**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

15

An increase in carbon dioxide would make the ocean more acidic because more  $\text{CO}_2$  would be in the atmosphere causing more  $\text{CO}_2$  to be in the ocean. There would be more evaporation meaning more water being evaporated <sup>so?</sup> and  $\text{CO}_2$  would start degassing into the atmosphere, which would start the cycle all over again. The problem with the ocean being more acidic would be because the shells would not form so all the organisms that live/eat shells would die which would cause the fisheries to collapse. a positive feedback would be if a volcano erupted in the ocean putting more  $\text{CO}_2$  in the atmosphere but even though the ash would block the visible light that reaches earth (the temperature would still go up) and more  $\text{CO}_2$  would still go into the atmosphere and ocean. a negative feedback loop would be in cloud formation because less energy will be released during cloud formation making earth's atmospheric temperature going down which means less  $\text{CO}_2$  going into the atmosphere, hydrosphere and biosphere causing the ocean to become less acidic which includes less evaporation which would be a negative feedback and temperature decreasing.

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- a. An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.  
b. Clear connections between events and changes in atmospheric temperature.

10

The greenhouse effect is when the sun emits its visible light to earth and the earth absorbs it but ~~reflects~~ <sup>re-emits</sup> the infrared radiation back into space and while most of it reaches space some still gets trapped by the greenhouse gases (methane, CO<sub>2</sub>, water vapor) and the bounce <sup>how?</sup> around with all this energy shooting the radiation back to space and down to earth causing earth's temperature to increase.

Because of convection, volcanoes erupt. They can only erupt from the lithosphere because it is brittle. When magma is rising it has these bubbles in it that helps it erupt. When it erupts it puts CO<sub>2</sub> and ash into the atmosphere and while the ash blocks the visible light from the sun, the influx of CO<sub>2</sub> in the atmosphere will increase the temperature. So if this happens from one volcano, if a lot of volcanoes started erupting the earth would become very hot and because the ash is blocking and keeping out the visible light, it is also keeping in all the CO<sub>2</sub>. So the ocean would become more acidic and it would be too much CO<sub>2</sub> in the atmosphere to process. Earth's temperature would steadily increase causing ocean reservoirs and land glaciers to decrease and the biosphere would start to die.

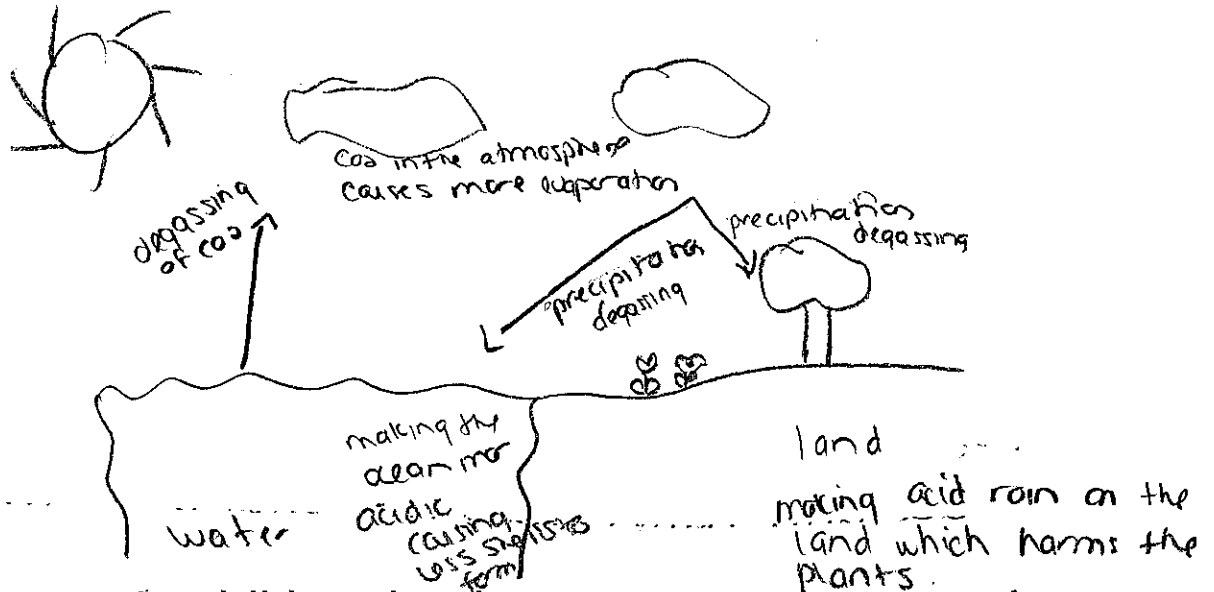
2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation and degassing are different because in evaporation it is a phase change and for degassing it stays the same in that it

Essay question 1

A41202816



Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

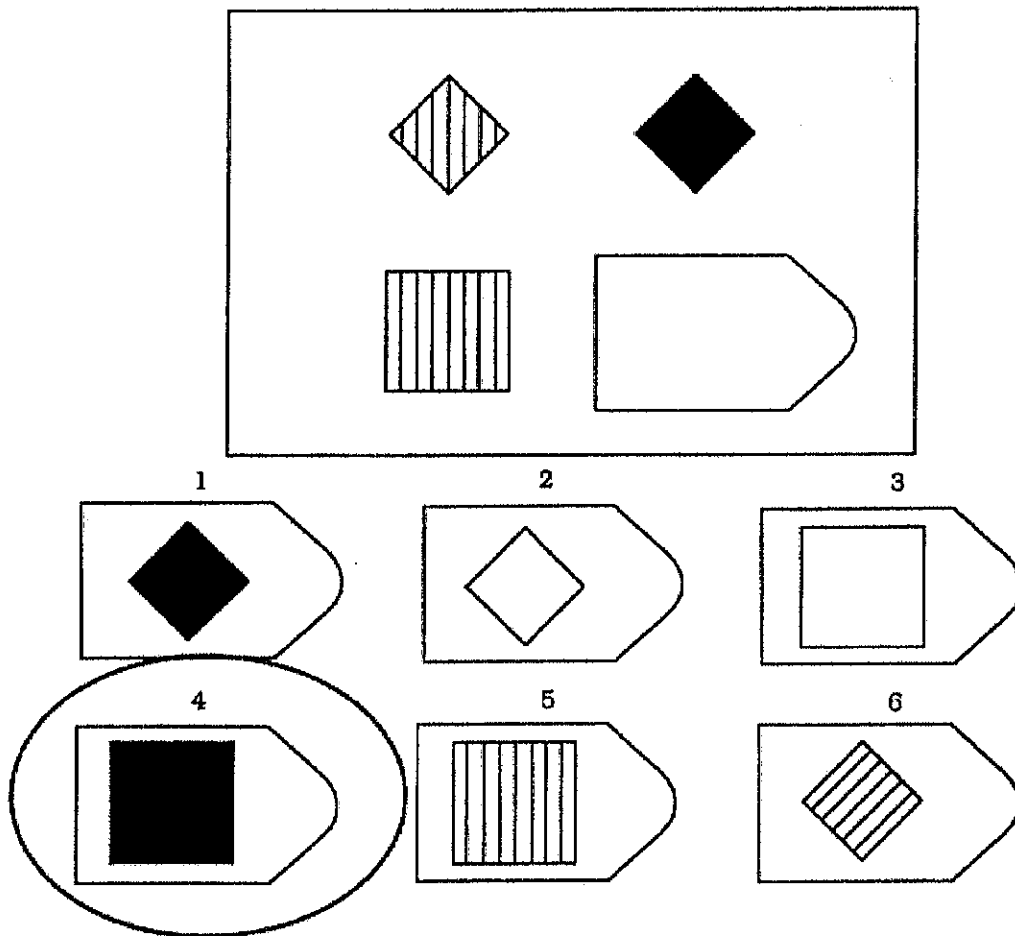


# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

Full 202516

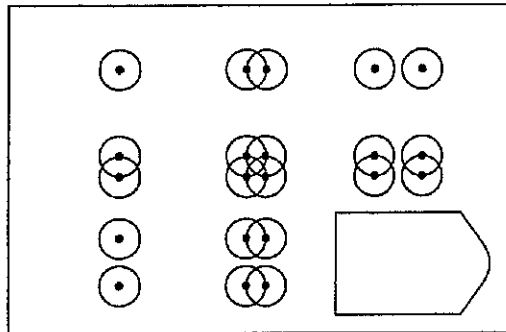


**Answer: 4**

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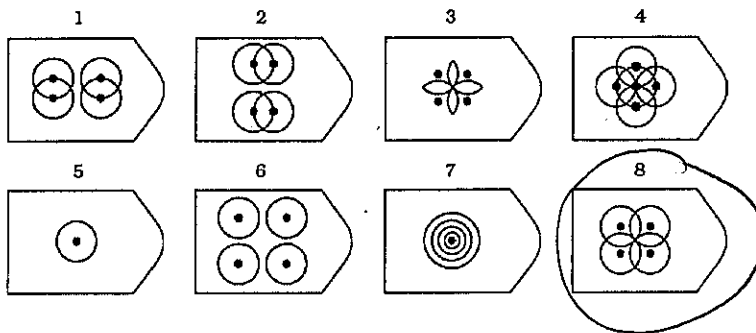
Please choose the image that best completes each of the following patterns.

### PATTERN 1

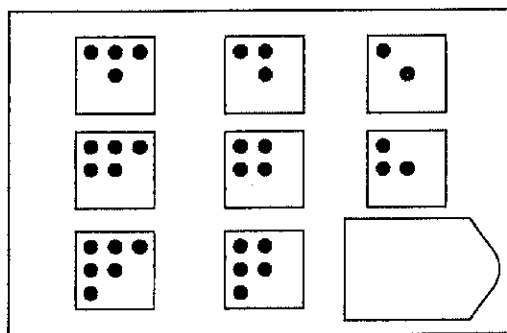


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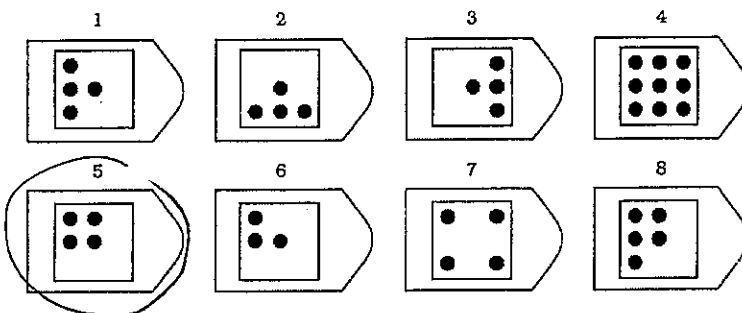
8



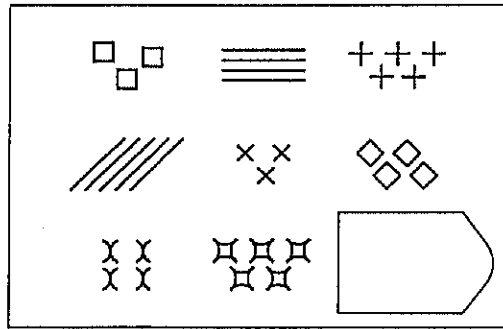
### PATTERN 2



5

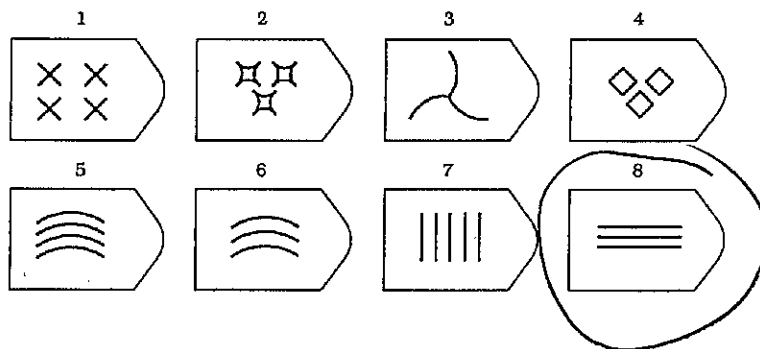


**PATTERN 3**

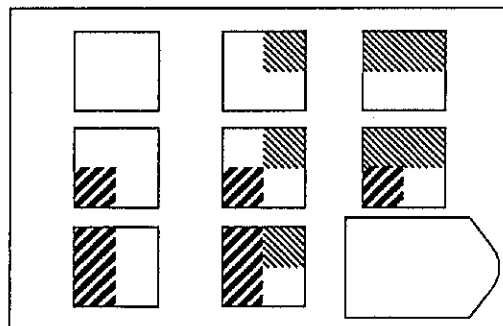


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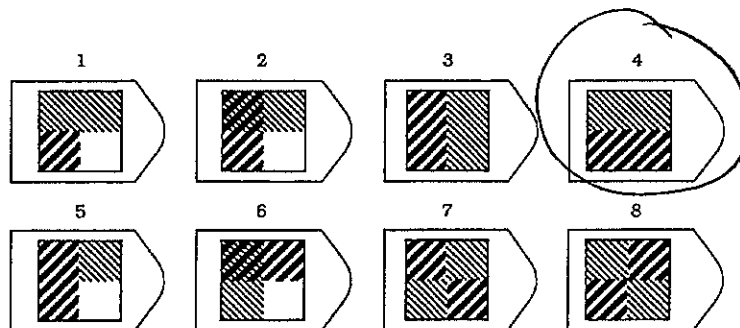
8



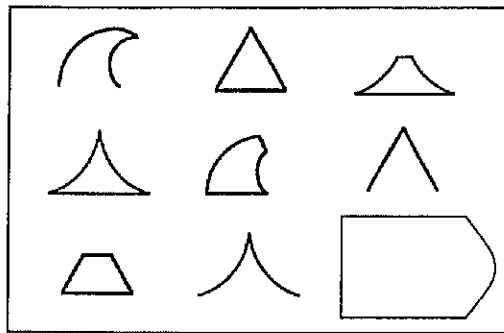
**PATTERN 4**



4

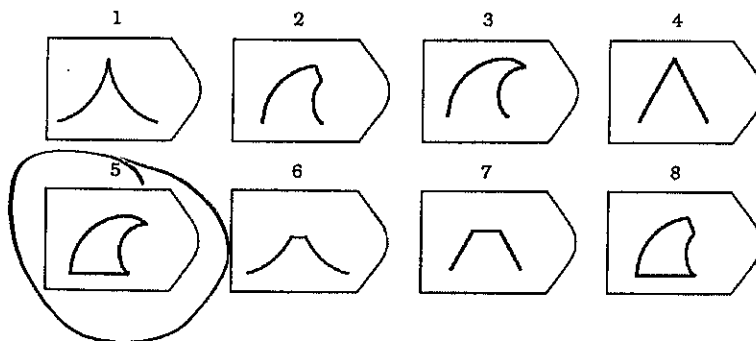


## PATTERN 5



A41202814

5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



*741262816*

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- B*
- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
  - ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
  - C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
  - D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- A*
- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
  - B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
  - C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
  - D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- D*
- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
  - B. Bob was able to maximize his work time by cutting back on watching TV during the day.
  - C. Sean has been closely monitoring his eating in an attempt to improve his diet.
  - ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- C*
- A. After eating a big lunch, Dan went back to his office and took a nap.
  - B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
  - ☒ C. Once he saw everyone else's formal suits, Dan went home to change clothes.
  - D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

A41262516

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 21 years

What is your home zip code? 48911

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: ~~XXXXXXXXXX~~  
Version B

GROUP: \_\_\_\_\_

A37730705

36

MULTIPLE-CHOICE. 5 points each (50 points total).

- ~~B~~ 1. Which of the following would be considered a negative feedback to increasing global temperature?
- a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - ☒ b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
- B 2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- a. The magma becoming colder
  - ☒ b. Gas bubbles forming in the magma
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma
- C 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of \_\_\_\_A\_\_\_\_. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of \_\_\_\_B\_\_\_\_ and compaction, and then limestone becomes exposed at Earth's surface through the processes of \_\_\_\_C\_\_\_\_.
- a. A= erosion, B= deposition, C= uplift and erosion
  - b. A = erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A = dissolution, B= deposition, C= uplift and deposition
- ~~OK~~ 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- a. Human activities are the primary cause of the greenhouse effect.
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
- B 5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.
- A 6. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ a. An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - b. A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - c. A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.

8. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
9. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
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10. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
11. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
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**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase of atmospheric  $\text{CO}_2$  raises ocean temperature, causing an increase in evaporation. With less water in the ocean reservoir, salt concentration increases and affects the deposition of calcium, causing a disequilibrium in the pH balance, and acidity decreases.



2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The increase of volcanic eruptions & ash clouds could cause a rise in Earth's atmospheric temperature, due to the release of methane, CO<sub>2</sub> & other ~~gas~~ chemicals. + ?

I

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

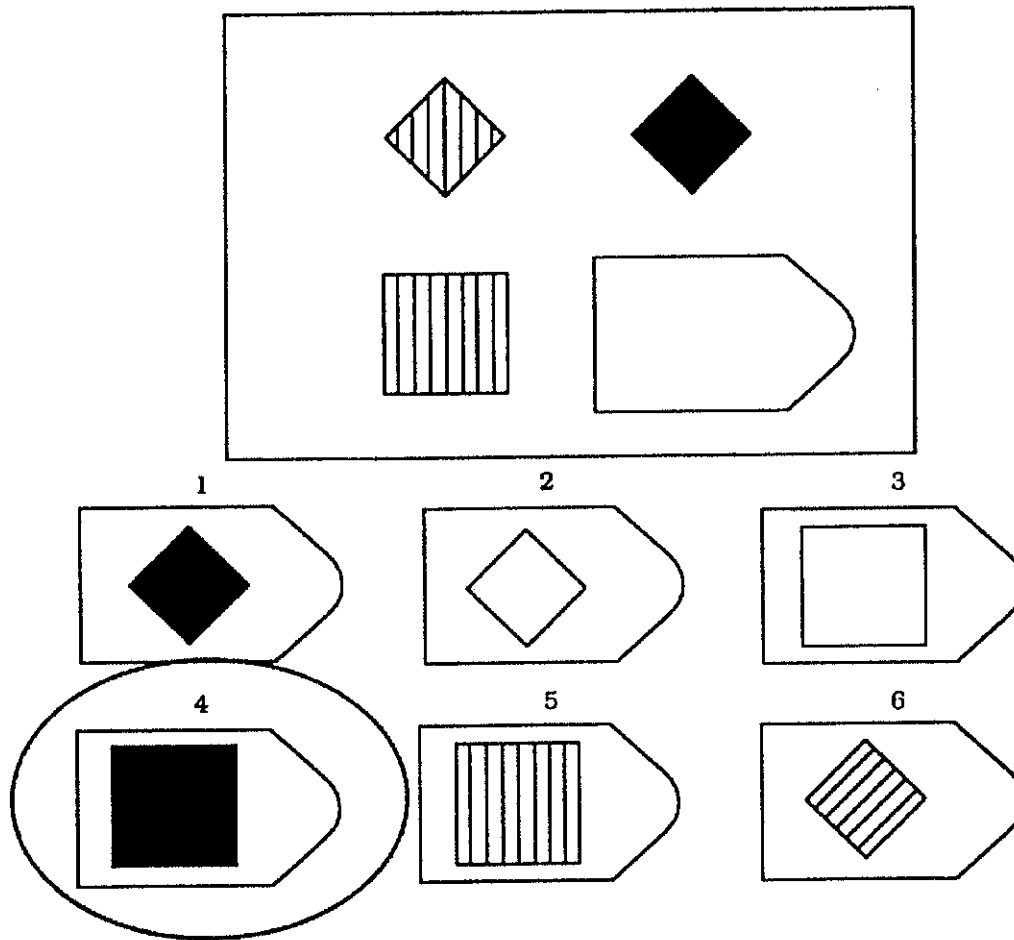




# Analogical Assessment

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*Example*

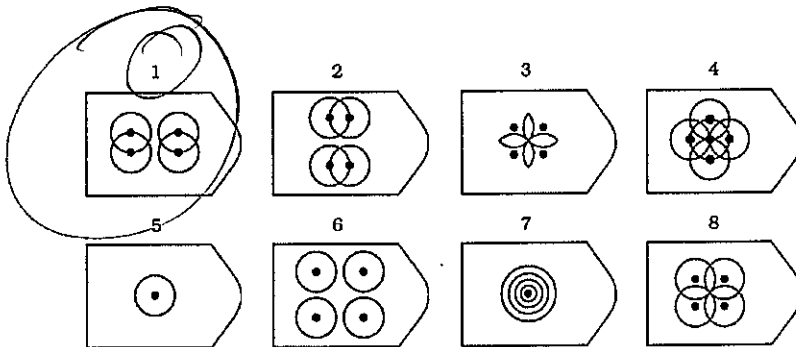
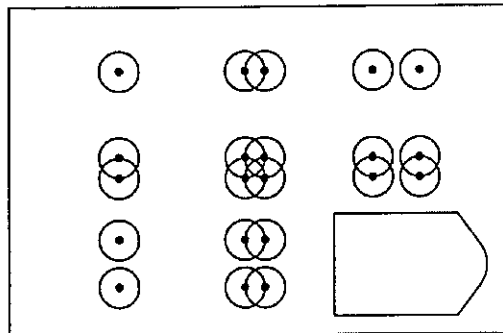


**Answer: 4**

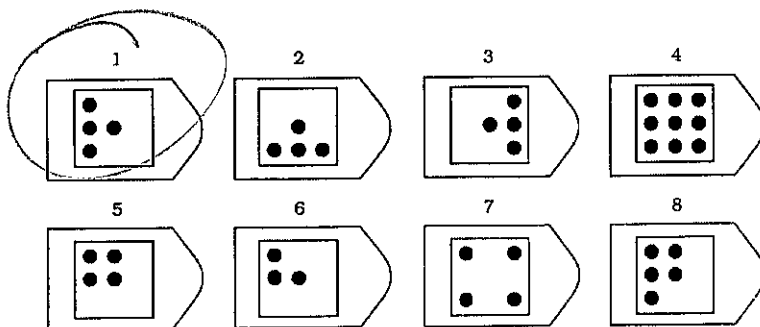
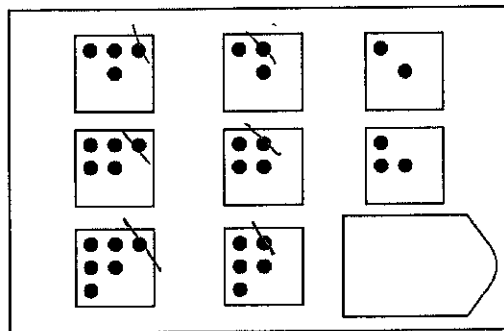
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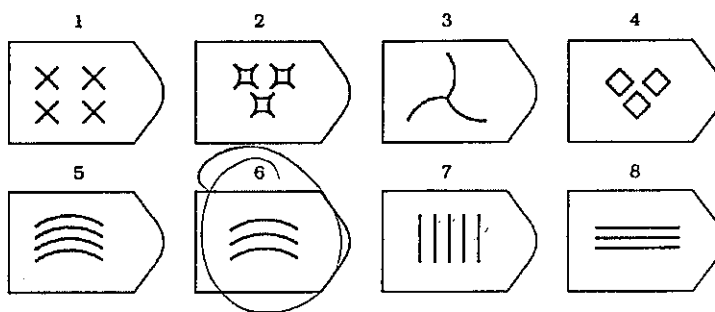
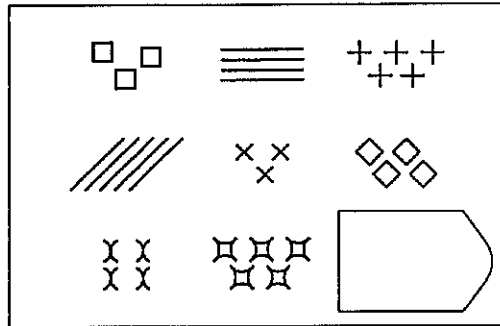
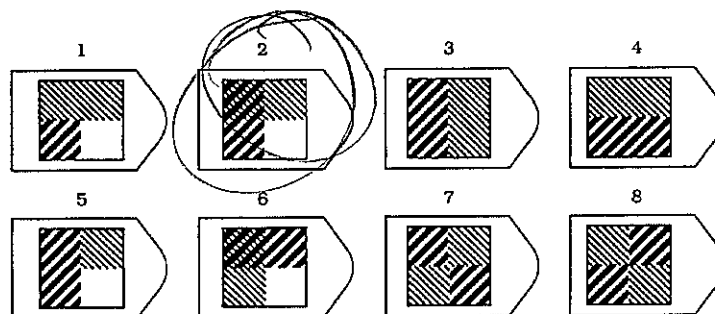
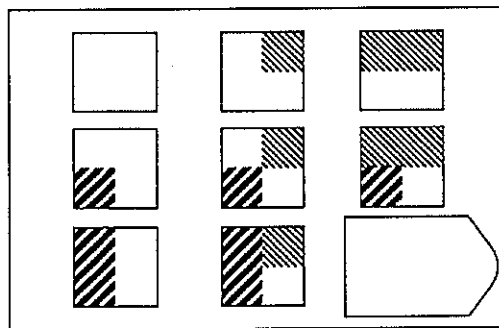
Please choose the image that best completes each of the following patterns.

### PATTERN 1

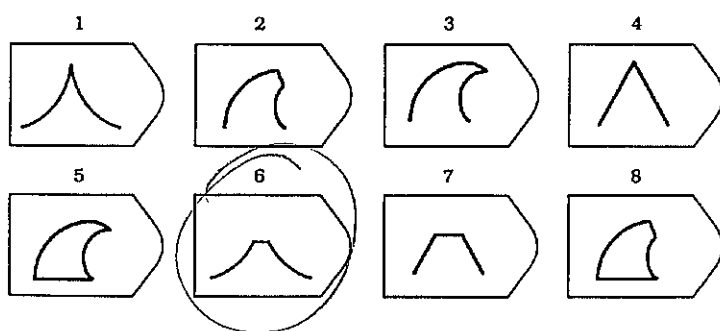
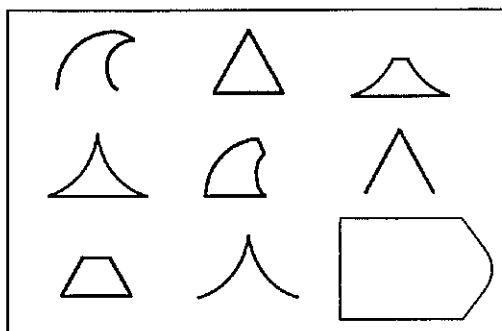


### PATTERN 2



**PATTERN 3****PATTERN 4**

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
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2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

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3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

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4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
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- D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- ☒ A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
- B. Because the course content for 'Literature of Eastern Europe' and 'Russian Literature' was highly similar, the administration decided to combine the courses and create a Slavic literature course.
- C. Because so many members of the Des Plaines Teamsters had left the union, their local branch disbanded.
- D. On the basis of new information, the police officer revisited the crime scene to look for new evidence.
- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- ☒ B. Hitting your head. They both involve something that causes headaches.
- C. Being sleep deprived. They both involve impaired functions.
- D. Eating too much candy. They both involve lack of self-control.
- E. Sleeping late. They are both caused by lack of self-control.

2. Water freezing is like...

- A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- ☒ C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48823

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

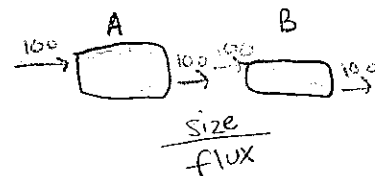
ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

STUDENT NAME: A41096642  
Version B

GROUP: T15

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following would be considered a negative feedback to increasing global temperature?
  - a. Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - b. Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - d. An increase in desert formation resulting in more dusting blowing into the atmosphere
  
2. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
  - a. The magma becoming colder - slows down
  - ☒ b. Gas bubbles forming in the magma making it less dense
  - c. The surrounding crust becoming hotter
  - d. Crystals forming in the magma - slows down
  
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
  - a. A= erosion, B= deposition, C= uplift and erosion
  - b. A= erosion, B= biochemical precipitation, C= uplift and deposition
  - ☒ c. A= dissolution, B= biochemical precipitation, C= uplift and erosion
  - d. A= dissolution, B= deposition, C= uplift and deposition
  
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
  - a. Human activities are the primary cause of the greenhouse effect. -increase in greenhouse effect
  - ☒ b. Natural processes are the primary cause of the greenhouse effect.
  - c. Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - d. Neither human activities nor natural processes are important causes of the greenhouse effect.
  - e. The human and natural causes of the greenhouse effect are not understood.
  
5. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
  - a. Reservoir A has a shorter residence time than Reservoir B.
  - ☒ b. Reservoir B has a shorter residence time than Reservoir A.
  - c. Reservoir A and Reservoir B have equal residence times.
  - d. More information about Reservoir A and Reservoir B is needed.



atmosphere to ocean

more CO<sub>2</sub> would have to be absorbed in atmosphere & clouds

1. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km}^3/\text{year}$  and an outflow of  $50 \text{ km}^3/\text{year}$ . Which of the following statements is true?

- a. The reservoir will eventually disappear.  
b. The reservoir is not in equilibrium.  
c. The reservoir is growing smaller.  
d. The reservoir's residence time is 10 years.



more in than out

$$\frac{\text{Size}}{\text{flux}} = \frac{1000}{100}$$

2. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?

- a. The Earth's atmosphere would become colder than it is today.  
b. The Earth's atmosphere would become warmer than it is today.  
c. The Earth's atmosphere would remain about the same temperature as it is today.  
d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

3. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?

- a. Reflection of more solar radiation, causing atmospheric temperature to decrease  
b. Reflection of more solar radiation, causing atmospheric temperature to increase  
c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase  
d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease

4. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?

- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.  
b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.  
c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.  
d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.

Negative feedback



**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in carbon in the atmosphere will result in more carbon being in the clouds. When it rains, more carbon will be put into the ocean. The rain is acid rain so there will be more ocean acidification. A negative feedback loop for ocean acidification would be an increase of  $\text{CO}_2$  in the atmosphere, leading to an increase in atmospheric temperature. This will cause more evaporation which will cause more clouds to form. When more clouds are formed, heat from the sun is being blocked, which will decrease atmospheric temperature. When more clouds are formed, more rain will occur. The rain has acid in it, which will cause ocean acidification. An example of positive feedback would be an increase in  $\text{CO}_2$ . An increase in  $\text{CO}_2$  will cause an increase in greenhouse gases which will increase the temperature in the atmosphere.

I came to your office before the exam ;)

ISP 203A: GLOBAL CHANGE

FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

4

A41096642

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

The increase in volcanism will cause earth's temperature to decrease <sup>then</sup> increase. If more volcanos are happening, more Carbon is being released into the atmosphere, but more ash is being released as well. When more ash is in the atmosphere heat is being blocked from being sent to the earth's surface. This will cause a decrease in temperature. While the heat is being blocked, CO<sub>2</sub> is being blocked as well in the atmosphere. This is due to the greenhouse effect. When the sun releases its energy, some is reflected and some is absorbed. The radiation will be bouncing back and fourth because the ash is there. When the ash goes away, there will be an increase in temperature because there was an increase in greenhouse gasses due to the CO<sub>2</sub> being trapped in the atmosphere.

15

2 Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Evaporation is moving liquid from the surface and forming a gas in the atmosphere.

A gas is moving a gas from one area to a gas in another area.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

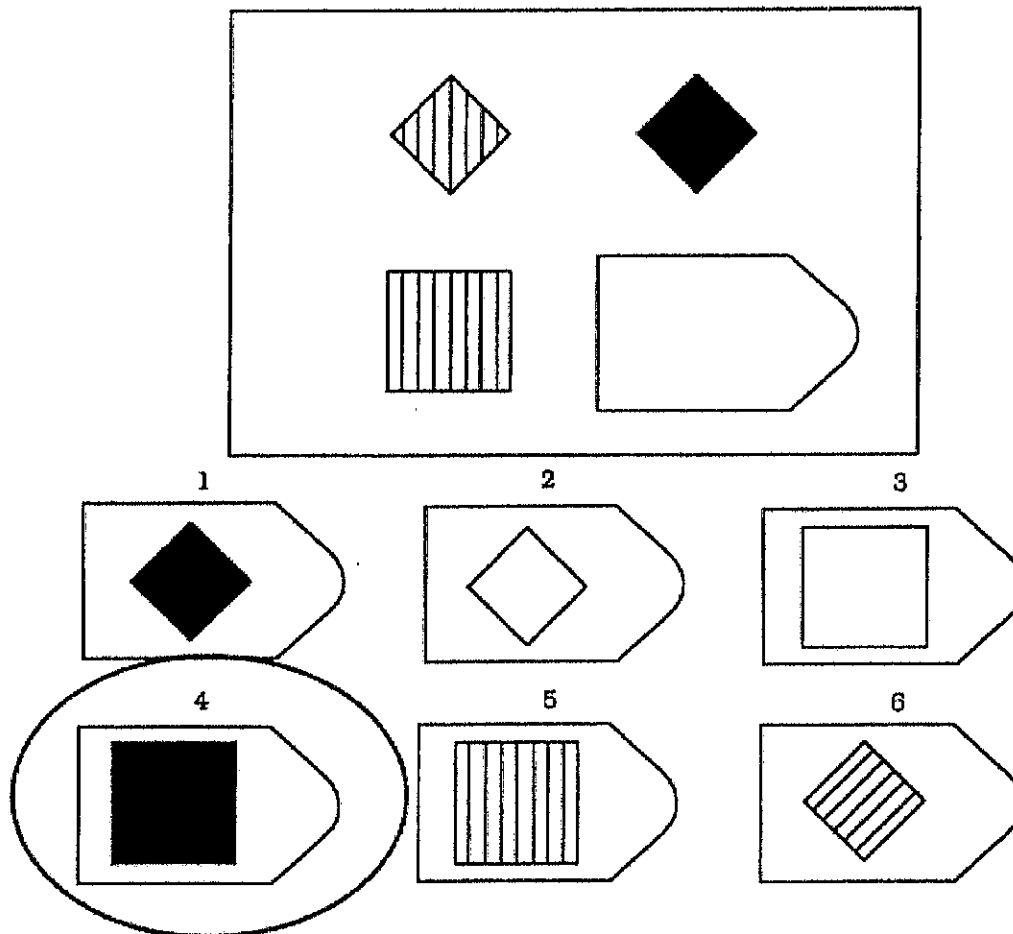
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

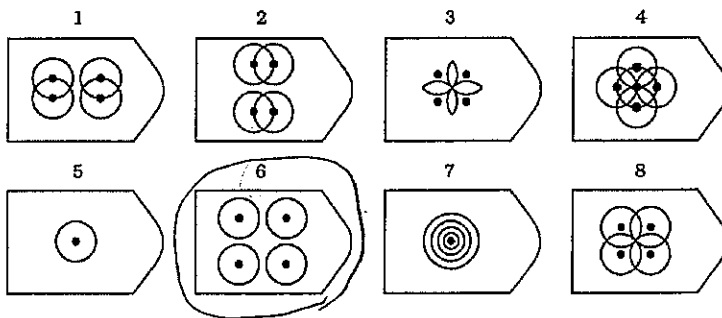
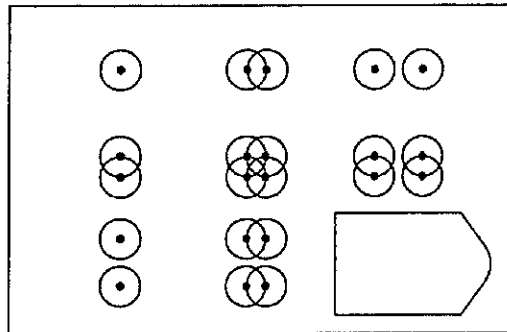


**Answer: 4**

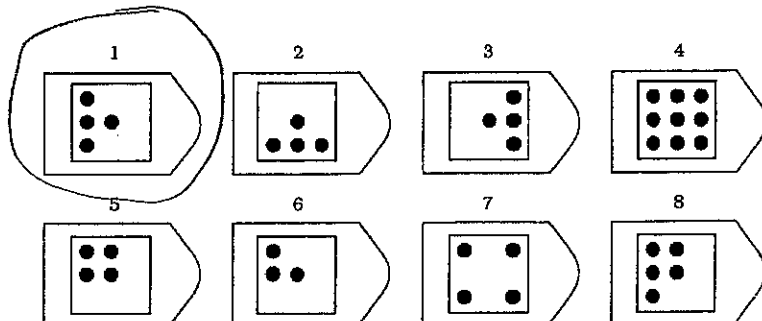
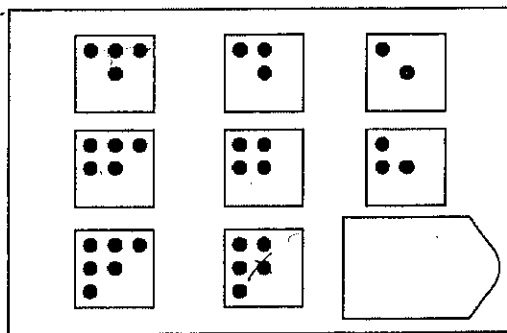
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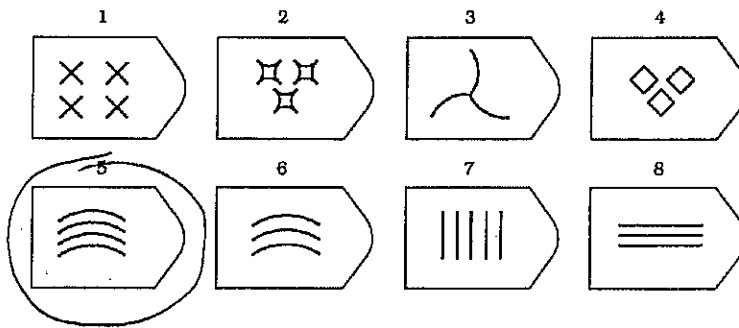
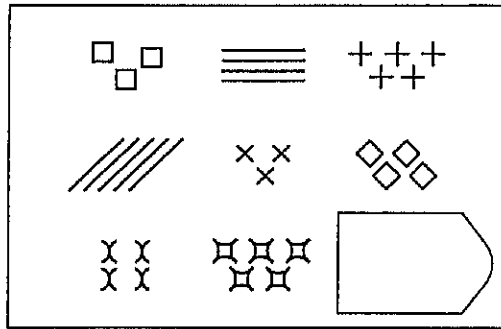
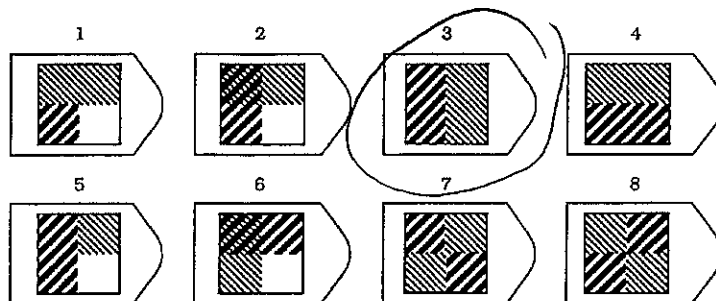
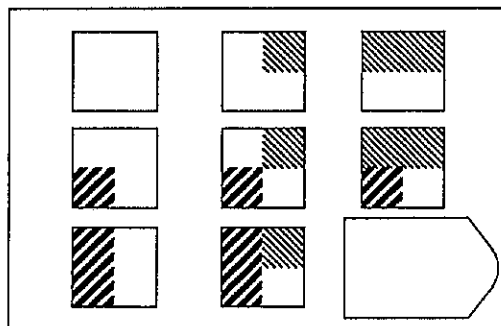
Please choose the image that best completes each of the following patterns.

**PATTERN 1**



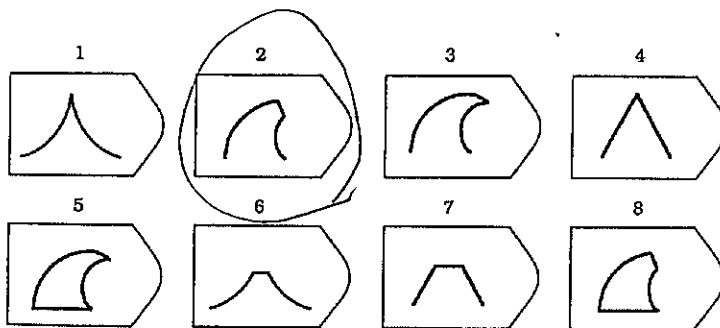
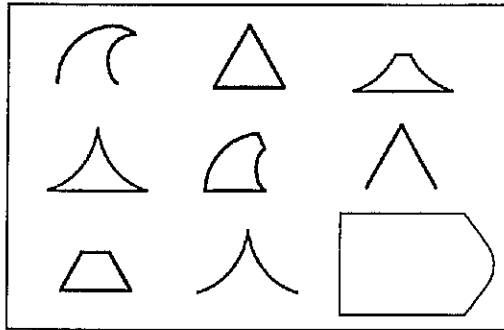
**PATTERN 2**



**PATTERN 3****PATTERN 4**

A41096642

## PATTERN 5



In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

*Example*

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. While testing a computer security system, the computer scientist accidentally released a destructive virus onto the internet.

- A. While debugging their broken firewall, a programmer came across top-secret CIA files.
- ☒ B. As the zoo keeper entered the habitat for cleaning, a wild tiger was able to escape into a local neighborhood.
- C. After realizing that many of their vehicles had been manufactured with faulty brakes, an automobile company issued a nationwide recall.
- D. When he realized that the public statement he had made might have been misleading, the politician went to great lengths to publicly correct any misconceptions.

2. In response to an embarrassing defeat, the volleyball coach scheduled several additional practices for the following week

- ☒ A. Alan did badly on the first exam for one of his classes, so he decided to put in several extra hours of study.
- B. Dan noticed a short break in the rainstorm, and made a dash from his building to the train station.
- C. Jim's band has their first big gig next week, so they rehearsed for 10 hours straight on Saturday.
- D. Some members of the basketball team suffered injuries on a ski trip, so they are spending many hours with the team physical therapist.

3. The couple saved for a fancy anniversary dinner by eating cheaply for the week beforehand.

- A. Joe had easier access to his recipes by consolidating his most frequently used recipes into a single binder.
- B. Bob was able to maximize his work time by cutting back on watching TV during the day.
- C. Sean has been closely monitoring his eating in an attempt to improve his diet.
- ☒ D. Mary opted not to take a "sick day" so that she would be able to have a longer Christmas vacation.

4. When she saw the menacing clouds, Margaret returned to her apartment to get an umbrella.

- A. After eating a big lunch, Dan went back to his office and took a nap.
- B. When the debate went badly, Ann decided to put more time into developing convincing arguments.
- C. Once he saw everyone else's formal suits, Dan went home to change clothes.
- ☒ D. When she heard the forecast, Jen became concerned about her plans for the weekend.

PLEASE CONTINUE ON NEXT PAGE

5. Due to an especially high drop rate that quarter, the administration decided to combine students from two introductory psychology courses into a single class.

- A. Because of low traffic volume, some of the underused outbound lanes of traffic are closed down in the morning.
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- 

Please choose the response that is closest to an analogy that you might make.

1. Getting drunk is like...

- A. Getting high. They are both involve too much of a chemical influencing the body.
- ~~B. Hitting your head. They both involve something that causes headaches.~~
- ☒ C. Being sleep deprived. They both involve impaired functions.
- ~~D. Eating too much candy. They both involve lack of self-control.~~
- ~~E. Sleeping late. They are both caused by lack of self-control.~~

2. Water freezing is like...

- ☒ A. Dew forming. They are similar because they both involve a drop in temperature.
- B. Blowing up a balloon. They are similar because they both involve becoming less dense.
- C. Clouds forming. They are similar because they both involve a phase change.
- D. Building a house. They are similar because they both involve building a structure.

## DEMOGRAPHICS

What is your age? 20 years

What is your home zip code? 48218

What is your gender?

- ☐ Male
- ☒ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☒ African American/Black
- ☐ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A39800329  
Version A

GROUP: T16

**MULTIPLE-CHOICE. 5 points each (50 points total).**

1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - ☒ Crystals forming in the magma
2. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - ☒ An increase in evaporation and cloud formation resulting in the release of latent heat
  - An increase in desert formation resulting in more dusting blowing into the atmosphere
3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - ☒ A = erosion, B = biochemical precipitation, C = uplift and deposition
  - A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - A = dissolution, B = deposition, C = uplift and deposition
4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- Human activities are the primary cause of the greenhouse effect.
  - ☒ Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
5. Which of the following would cause the acidity of Earth's oceans to decrease?
- An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - ☒ A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.

$$A = 2 \times B = \text{longer residence time}$$

A39800329

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2

7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
  - ☒ b. The reservoir is not in equilibrium.
  - c. The reservoir is growing smaller.
  - d. The reservoir's residence time is 10 years.
8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a. Reflection of more solar radiation, causing atmospheric temperature to decrease
  - ☒ b. Reflection of more solar radiation, causing atmospheric temperature to increase
  - c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
  - d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
  - ☒ b. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
  - c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
  - d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- ☒ a. The Earth's atmosphere would become colder than it is today.
  - b. The Earth's atmosphere would become warmer than it is today.
  - c. The Earth's atmosphere would remain about the same temperature as it is today.
  - d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.

A39800329

## SHORT ANSWER. 25 points each (50 points total)

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

As atmospheric carbon dioxide increases, so does carbon dioxide in the ocean. Carbon dioxide reacts with water to form bicarbonate and hydrogen ions in the ocean. Due to the fact that acidity is the concentration of ions in water, an increase in hydrogen ions will produce an increase in oceanic acidity.

With respect to positive feedback loops, an increase in atmospheric carbon dioxide produces an increase in oceanic carbon dioxide which in turn produces an increase in acidity. This is an example of positive feedback.

With respect to negative feedback loops, earth's atmospheric temperature will decrease.

2  
20

20

A39800329

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

4

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

5

This increase in volcanism would decrease earth's atmospheric temperature due to the formation of clouds. In addition, the earth will receive less energy from the sun's heat due to the blocking by the large ash clouds; thus the greenhouse effect contributes in this example to earth's atmospheric temperature decrease.

Specifically, the sun's heat source will be hindered from the production of clouds; the clouds block heat from the sun, and as a result, earth's atmospheric temperature decrease.

With respect to clear connections (b), the decrease in earth's atmospheric temperature will also produce a decrease in oceanic temperature.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

Both involve oxidation?

jo

A39800329

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

**Thoughtfully complete the attached survey**

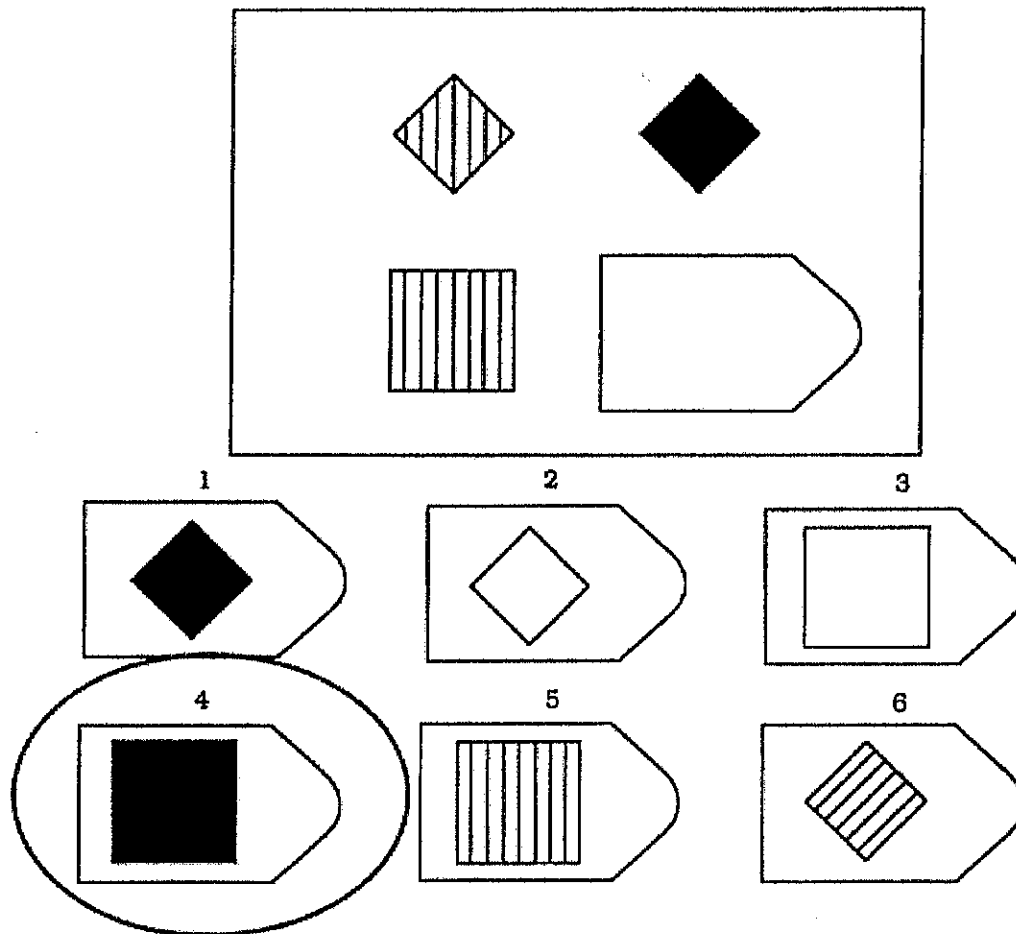




# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

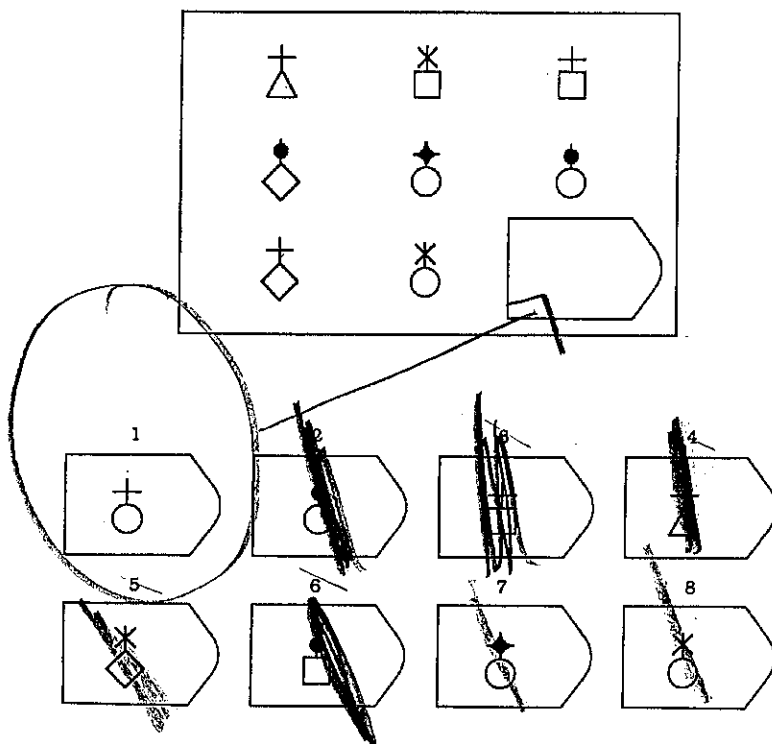


**Answer: 4**

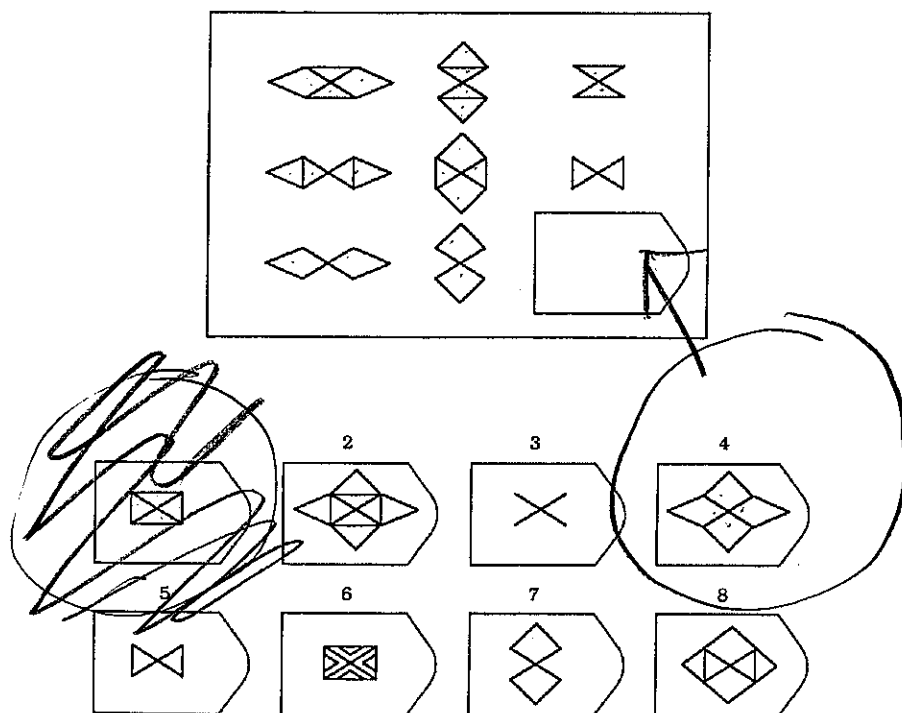
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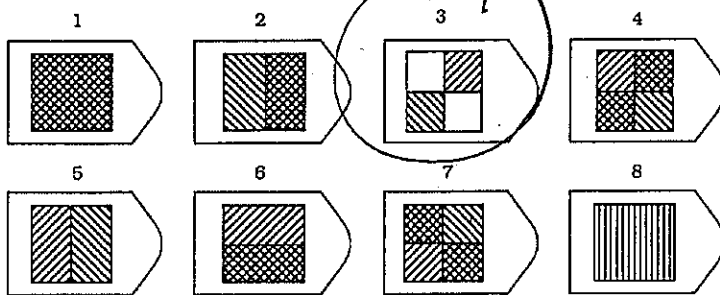
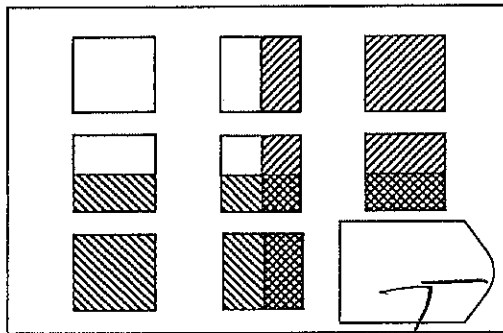
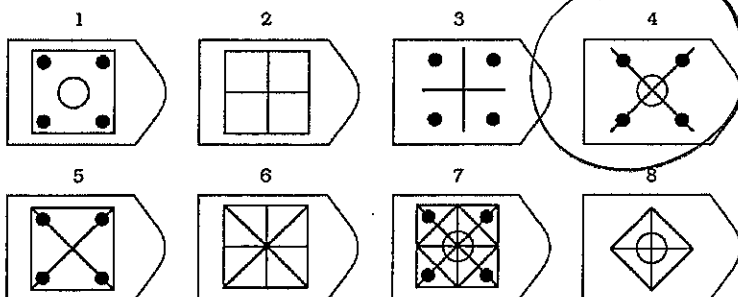
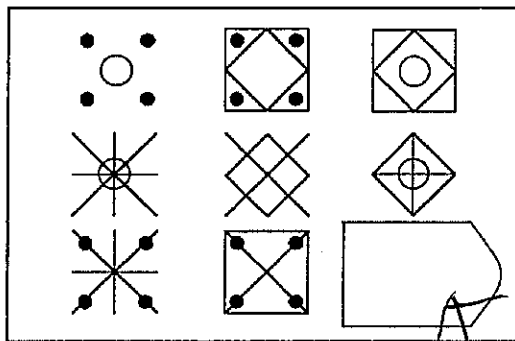
Please choose the image that best completes each of the following patterns.

### PATTERN 1

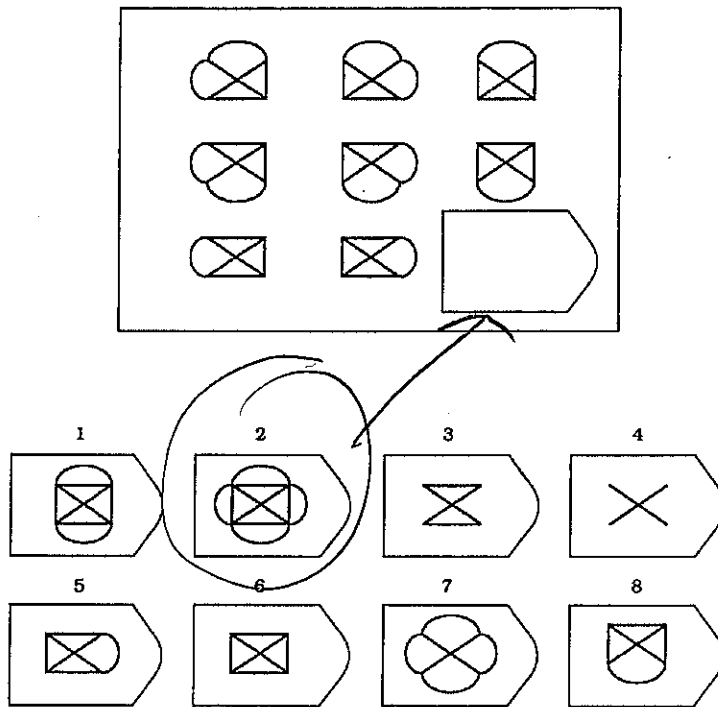


### PATTERN 2



**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE

Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.

- A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
- B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
- ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
- D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.

2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.

- A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
- B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
- C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
- ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.

3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.

- A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
- ☒ B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
- ☒ C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
- ☒ D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.

4. The rival gangs used graffiti to define their territorial boundaries.

- ☒ A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
- B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
- ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
- D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE

5. The father repaired his daughter's toy, since he had been the one who accidentally stepped on it.
- A. The plumber fixed the pump that had burst and flooded the basement.
  - B. Steven avoided midweek outings in order to have the time for a weekend trip out of town
  - C. The groom's mother mended her son's tuxedo since he had torn a hole in it.
  - ☒ D. The supplier realized that he had failed to make an important shipment, and immediately sent it Federal Express at his own expense.
- 

Please choose the response that is closest to an analogy that you might make.

1. A balloon floating is like...

- A. An ice cube in water. They are similar because they both are less dense than the surrounding material.
- ☒ B. A leaf in the air. They are similar because they both move through the air carried by the wind.
- C. Blowing bubbles. They are similar because they both float until they eventually pop.
- D. A cloud in the sky. They are similar because they both float and are carried by the wind.

2. Catching a cold is like...

- ☒ A. Getting the flu. They are similar because they are both caused by viruses.
- B. Getting pink eye. They are similar because they are both contagious.
- C. Getting the flu. They are similar because they are both caused by not washing your hands.
- D. Forgetting to do your homework. They are similar because they are both preventable.
- E. Not getting enough sleep. They are similar because they both involve a weakened immune system.

#### DEMOGRAPHICS

What is your age? 22 years

What is your home zip code? 48323

What is your gender?

- ☒ Male
- ☐ Female
- ☐ Transgender

What is your ethnicity? CHOOSE ALL THAT APPLY.

- ☐ African American/Black
- ☒ Caucasian
- ☐ Latino/Hispanic
- ☐ Native Hawaiian/Pacific Islander
- ☐ Native American
- ☐ Other

STUDENT NAME: A40543777

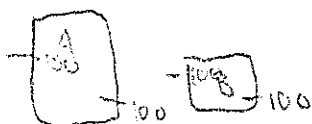
GROUP: T16

Version A

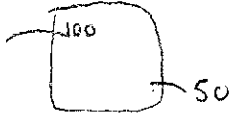
90

**MULTIPLE-CHOICE. 5 points each (50 points total).**

- B 1. Which of the following changes would cause a rising magma to increase the rate at which it rises toward the surface?
- The magma becoming colder
  - ☒ Gas bubbles forming in the magma
  - The surrounding crust becoming hotter
  - Crystals forming in the magma
- D 2. Which of the following would be considered a negative feedback to increasing global temperature?
- Melting of ice sheets resulting in more visible energy from the Sun being absorbed
  - Melting of permafrost resulting in more methane escaping into the atmosphere
  - c. An increase in evaporation and cloud formation resulting in the release of latent heat
  - ☒ An increase in desert formation resulting in more dusting blowing into the atmosphere
- D 3. Fill in the blanks. Calcium atoms in a limestone at Earth's surface become calcium atoms in solution through the process of A. Eventually, these same atoms reach the ocean where they become a part of crystalline limestone through the process of B and compaction, and then limestone becomes exposed at Earth's surface through the processes of C.
- A = erosion, B = deposition, C = uplift and erosion
  - A = erosion, B = biochemical precipitation, C = uplift and deposition
  - A = dissolution, B = biochemical precipitation, C = uplift and erosion
  - ☒ A = dissolution, B = deposition, C = uplift and deposition
- A 4. Which of the following statements about the greenhouse effect on Earth is most accurate?
- ☒ Human activities are the primary cause of the greenhouse effect.
  - Natural processes are the primary cause of the greenhouse effect.
  - Human activities and natural processes are roughly equal causes of the greenhouse effect.
  - Neither human activities nor natural processes are important causes of the greenhouse effect.
  - The human and natural causes of the greenhouse effect are not understood.
- A 5. Which of the following would cause the acidity of Earth's oceans to decrease?
- ☒ An increase in ocean temperature due to an increase in atmospheric carbon dioxide.
  - A decrease in ocean temperature due to blocking of solar radiation by volcanic ash.
  - A decrease in ocean temperature due to a decrease in solar radiation emitted by the Sun.
- B 6. Imagine two CO<sub>2</sub> reservoirs. Reservoir A is twice the size of Reservoir B. In both Reservoirs A and B, CO<sub>2</sub> influx and CO<sub>2</sub> outflow are equal. Which reservoir has the shorter residence time?
- Reservoir A has a shorter residence time than Reservoir B.
  - ☒ Reservoir B has a shorter residence time than Reservoir A.
  - Reservoir A and Reservoir B have equal residence times.
  - More information about Reservoir A and Reservoir B is needed.



**ISP 203A: GLOBAL CHANGE**  
**FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points**

- B** 7. A reservoir is  $1000 \text{ km}^3$  in size, has an influx of  $100 \text{ km/year}$  and an outflow of  $50 \text{ km/year}$ . Which of the following statements is true?
- a. The reservoir will eventually disappear.
- b.** The reservoir is not in equilibrium.
- c. The reservoir is growing smaller.
- d. The reservoir's residence time is 10 years.
- $1000 \quad \frac{100}{50} = 2$
- 
- A** 8. Imagine the Earth's atmospheric temperature is decreasing. This decrease in temperature will cause glaciers to form. What will be the effect of glacial formation?
- a.** Reflection of more solar radiation, causing atmospheric temperature to decrease
- b. Reflection of more solar radiation, causing atmospheric temperature to increase
- c. Re-emitting of more infrared radiation, causing atmospheric temperature to increase
- d. Re-emitting of more infrared radiation, causing atmospheric temperature to decrease
- B** 9. Imagine that Earth's atmospheric temperature is increasing. This causes more evaporation and therefore the formation of more clouds. Which of the following statements is true?
- a. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a positive feedback to Earth's atmospheric temperature.
- b.** More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a positive feedback to Earth's atmospheric temperature.
- c. Less energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go down. This is a negative feedback to Earth's atmospheric temperature.
- d. More energy will be released during cloud formation, and therefore Earth's atmospheric temperature will go up. This is a negative feedback to Earth's atmospheric temperature.
- B** 10. What would happen to Earth's atmospheric temperature if the countries of the world limited human-caused greenhouse gas emissions to 1990 rates?
- a. The Earth's atmosphere would become colder than it is today.
- b.** The Earth's atmosphere would become warmer than it is today. - The 1990 rates are unnatural and would continue the global warming.
- c. The Earth's atmosphere would remain about the same temperature as it is today.
- d. The role of positive and negative feedbacks makes it impossible to determine if Earth's atmospheric temperature would increase, decrease, or remain the same.





**SHORT ANSWER. 25 points each (50 points total)**

1. How would an increase in atmospheric carbon dioxide affect ocean acidification?

Your answer should include:

- An explanation of the process of ocean acidification. You may draw a diagram, explain the process in words, or both. This equation may be helpful:  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$
- Discussion of both negative and positive feedback loops to the process of ocean acidification.

An increase in atmospheric carbon dioxide would play a large role in ocean acidification. Ocean acidification is the process where ocean pH is decreased, causing more acidic seawater. The carbon cycle has a huge effect on ocean acidification and many of the positive and negative feedbacks associated with the atmosphere and ocean acidification. 25

The negative feedbacks of ocean acidification have to do with temperature and  $\text{CO}_2$  levels. As  $\text{CO}_2$  levels increase, atmospheric temperature continues to increase which would increase the ocean temperature, making the ocean less suitable to store  $\text{CO}_2$ . As more water is evaporated into the atmosphere, atmospheric  $\text{CO}_2$  levels continue to rise and heat the planet, continually causing more evaporation and so on.

The positive feedbacks of ocean acidification also are associated with temperature and  $\text{CO}_2$ . As the  $\text{CO}_2$  levels increase, the atmospheric temperature increases which causes glacial melting and an increase of solar radiation absorbed and re-emitted. This atmospheric heating causes the atmospheric gases to constantly expand, forcing the ocean (a  $\text{CO}_2$  reservoir) to absorb more gases including  $\text{CO}_2$  which...  $\text{CO}_2 + \text{H}_2\text{O} \leftrightarrow \text{HCO}_3^- + \text{H}^+$  ... drives ocean acidification.

The net effect of an increase of atmospheric  $\text{CO}_2$  on ocean acidification would depend on which feedback loops made greater impacts.

ISP 203A: GLOBAL CHANGE  
FINAL EXAM; Sibley/Libarkin, Spring 2011; 100 points

2. Imagine volcanism on Earth suddenly increases dramatically, particularly volcanoes that erupt large ash clouds. How would this increase in volcanism affect Earth's atmospheric temperature?

Your answer should include:

- An explanation of all processes related to volcanism that influence atmospheric temperature. This will include an explanation of the greenhouse effect.
- Clear connections between events and changes in atmospheric temperature.

25

not quite  
OK  
An increase in volcanism causing large ash clouds would have adverse effects on atmospheric temperature. The process by which the Earth's atmosphere is heated is the greenhouse effect. The green house effect is the process where certain atmospheric gases trap the infrared energy emitted from the Earth and [solar radiation in] our atmosphere. This "trapping" of energy in our atmosphere increases the atmospheric temperature.

OK  
The volcanic ash cloud that could come to existence would counter the effects of the greenhouse effect by disrupting the key processes. The ash cloud would prevent solar radiation from reaching the Earth's surface and therefore reduce the amount of solar radiation absorbed and re-emitted into our atmosphere in the form of infrared energy. The reduction of infrared energy being emitted would cause a decrease in the infrared energy absorbed by the greenhouse gases, which would tend to cause an atmospheric-cooling effect.  
OK

Over time with rising levels of CO<sub>2</sub> and other greenhouse gases in the atmosphere, it is likely that the volcanic ash cloud would only slow the greenhouse effect, not stop or reverse it. Over a long enough time, atmospheric temperature would continue to rise.

Extra credit (2 points).

How are evaporation and degassing similar and/or different?

They are both examples of outflux from one reservoir to another. They are both involved in cyclical processes.

Earn up to 1 additional point on your course grade

[ex. a 79% becomes an 80%]

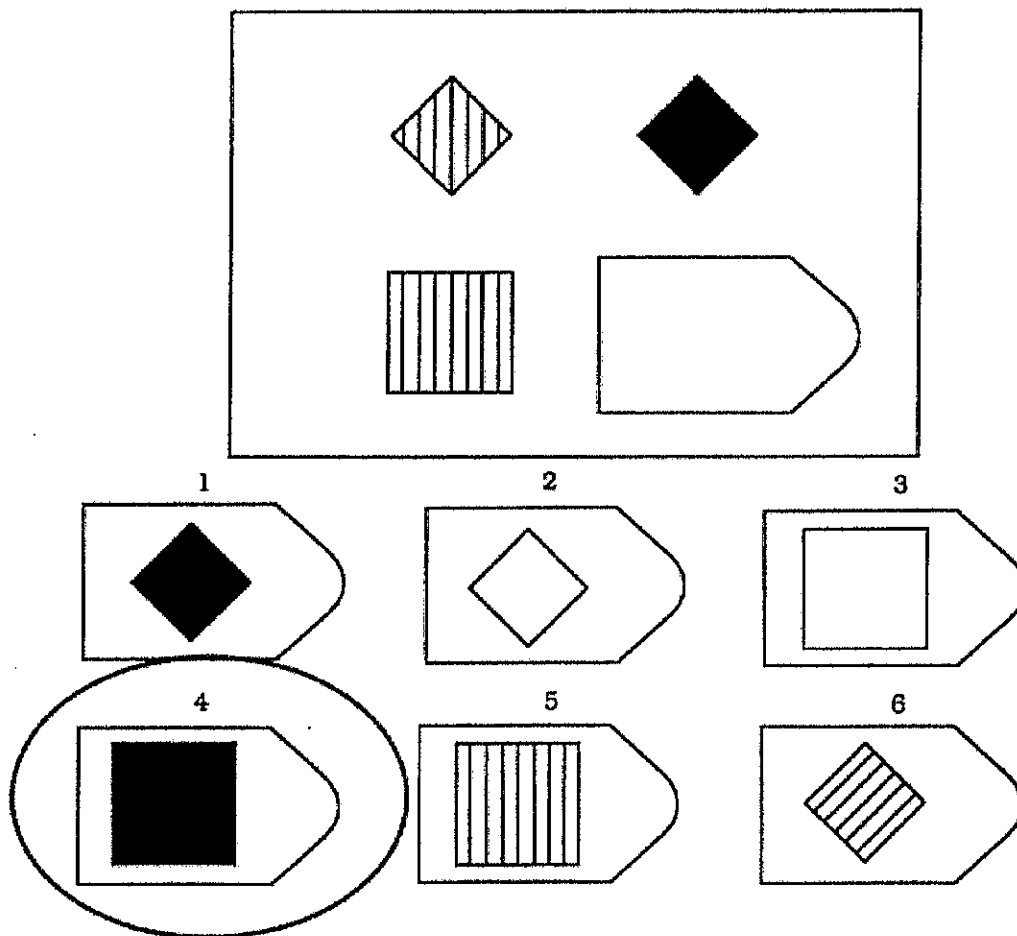
**Thoughtfully complete the attached survey**



# Analogical Assessment

In this exercise, you will be asked to solve a set of visual problems. In each problem, you will see a set of images that form a pattern. However, one image will be missing. You must choose the image that best completes the pattern.

*Example*

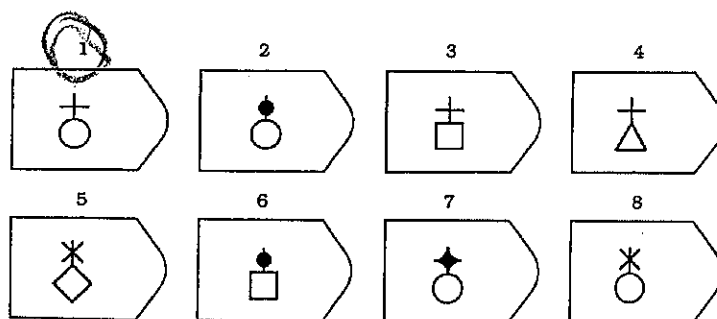
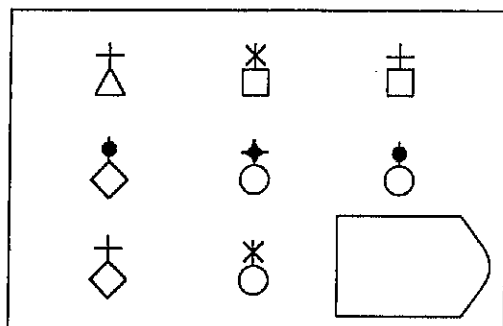


**Answer: 4**

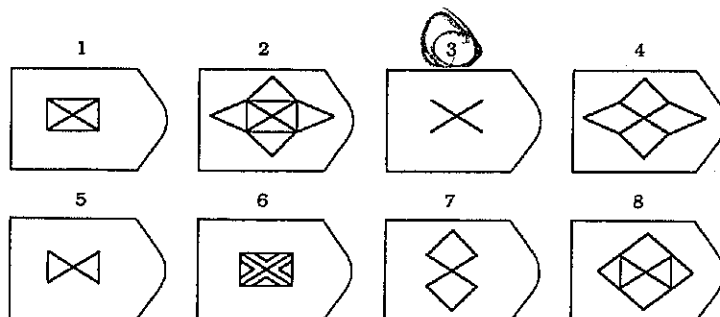
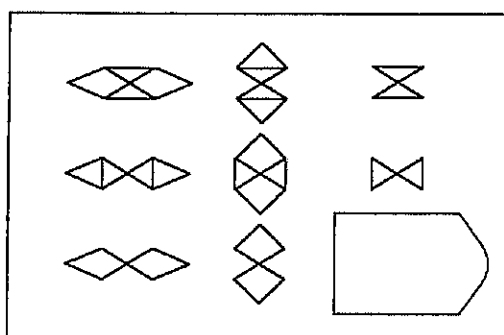
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Please choose the image that best completes each of the following patterns.

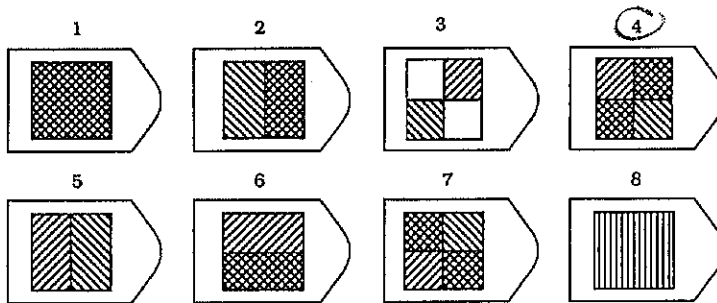
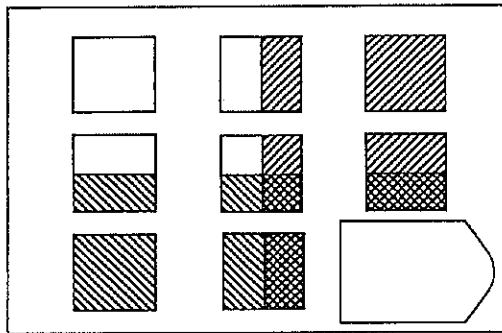
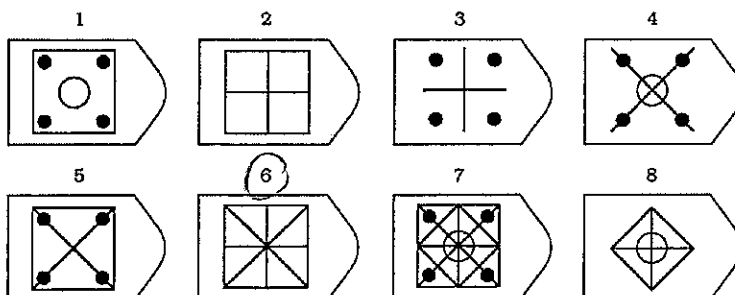
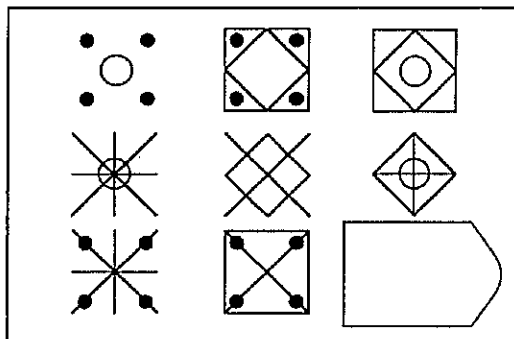
### PATTERN 1



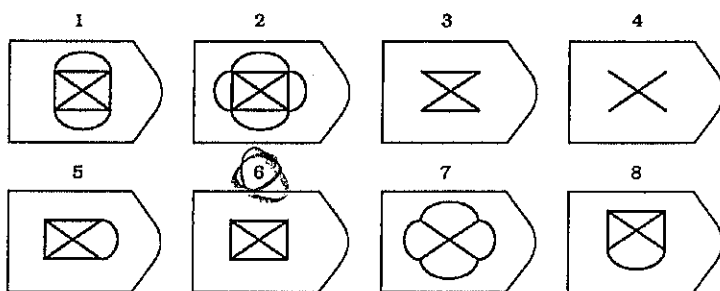
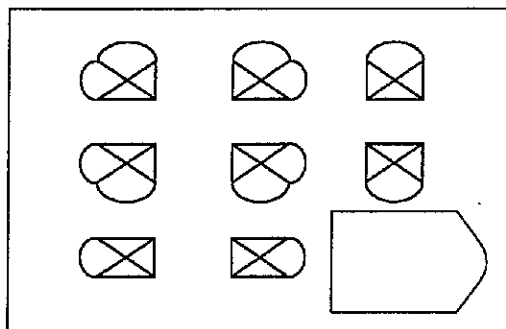
### PATTERN 2



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**PATTERN 3****PATTERN 4**

PLEASE CONTINUE ON NEXT PAGE

**PATTERN 5**

In this next exercise you will be presented with a base statement and three answer statements. The object of this exercise is to match the base statement with an answer statement that is the best analogy to the base.

**Example**

Base: Several pit stops during the race gave the car a chance to refuel and receive minor adjustments.

- A. While migrating south for the winter months, the flock of geese would frequently stop near bodies of water for rest and rehydration.
- ☒ B. Once the couple had had finished putting together their new entertainment center, the rest of the afternoon was spent rearranging furniture to accommodate it.
- C. The car manufacturer decided to discontinue the model after research showed the faulty mechanism could have serious consequences.

PLEASE CONTINUE ON NEXT PAGE



Please choose the best analogy to each of the following statements.

1. The thieves knew that the driver would only be in the restroom for a short time, so they worked quickly to pick the lock on the armored car.
  - A. The experienced locksmith did not need much time to remove the padlock that no longer had a key.
  - B. Tommy knew that his parents would be angry, so he hacked into the school's database and changed his grades.
  - ☒ C. When John noticed that the guest speaker was free for a minute, he hurried over to talk to him and ask advice.
  - D. Prometheus stole fire from the top of Mt. Olympus and brought it to mankind, allowing great advances in human civilization.
  
2. After only a week of vegetarianism, George relapsed into his prior meat-eating habits.
  - A. Before the annual parade, the city council decided to renovate one of the buildings downtown.
  - B. During a visit to the doctor, Emily was informed that she must take more vitamins to continue her vegetarian diet.
  - C. Despite requests from her family, Lisa continued to overwork herself with long hours at the lab.
  - ☒ D. Even though her New Year's resolution was to spend less time on Facebook, by February Anna was again logging onto Facebook every five minutes.
  
3. The surveillance aircraft returned to its base with photographs and intelligence for the country's leaders, allowing a critical defense strategy to be set up.
  - ☒ A. The lioness came back after the hunt and brought freshly killed meat to her cubs, satisfying their growing need for food.
  - B. Allison took her pedigreed border collie to the professional groomer, and ensured that the collie would be looking its best at the dog show.
  - C. Joan returned home from work with some takeout from an Indian restaurant, but her kids had already eaten.
  - D. The spy amassed hundreds of photos of the enemy's weapons production plant, and still nothing could be done to stop them from developing nuclear weapons.
  
4. The rival gangs used graffiti to define their territorial boundaries.
  - A. The toddler wrote on the walls with pens when the babysitter wasn't looking.
  - B. Artists were commissioned to paint murals on the sides of old buildings in an effort to beautify the city.
  - ☒ C. The cat rubbed against the new sofa, marking it with her scent and claiming it as her property.
  - D. The government that was installed after the coup proved to be very unstable, and soon the original regime was back in control of the country.

PLEASE CONTINUE ON NEXT PAGE